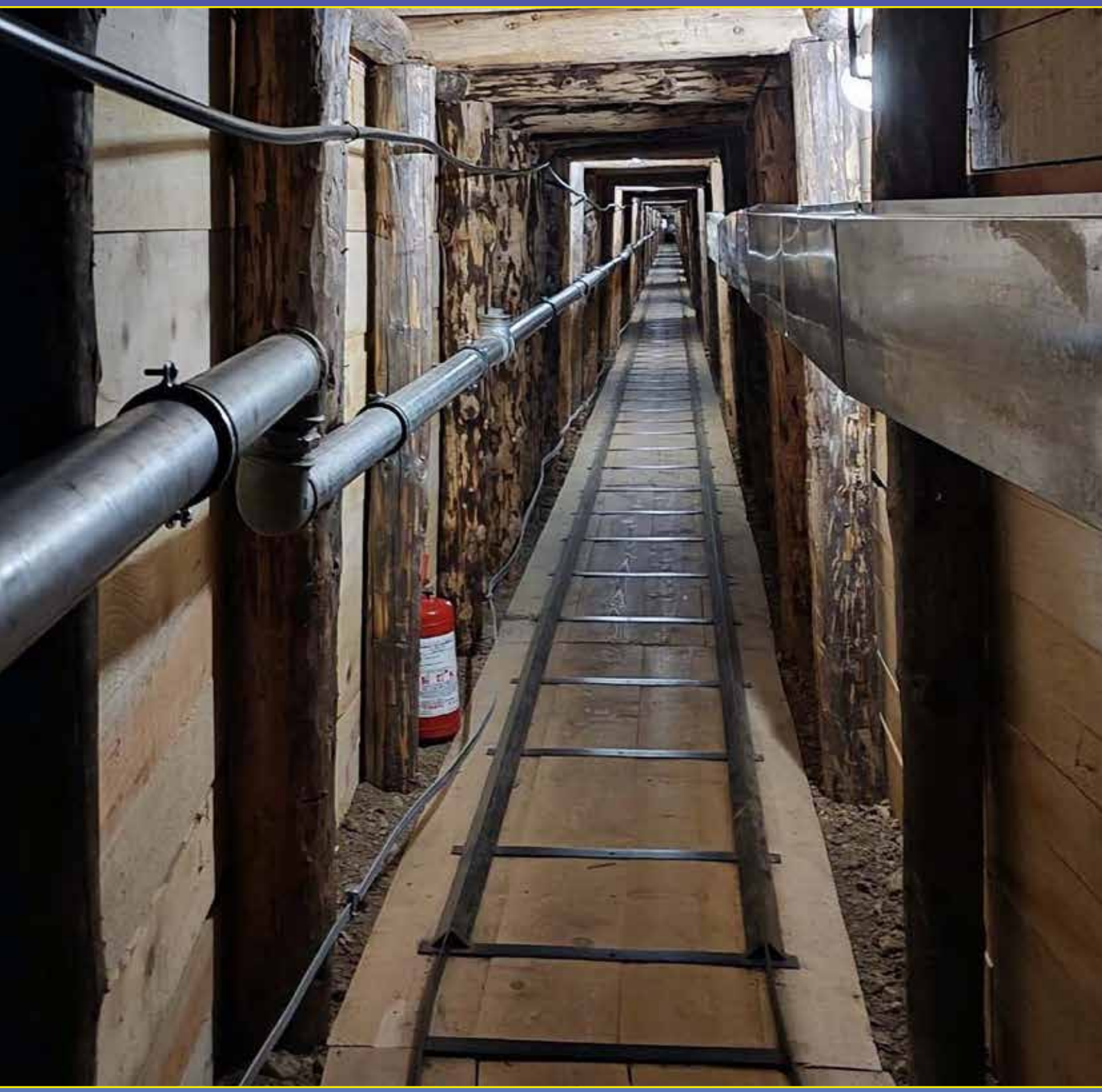
Subterranea

The Magazine for Subterranea Britannica



Subterranea Britannica **December 2022 Issue 61**

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Regan Vest bunker – Denmark
Highgate Cemetery catacombs
Sub Brit visit to Orford Ness
Sarajevo Tunnel Of Hope

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life.
Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.
Contributors to *Subterranea* also give their permission for articles and images to be reproduced on Sub Brit's website.

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Front cover photo: *Sarajevo's 'Tunnel of Hope' showing fuel pipe, telephone and electricity supply cables and track for goods trolleys. The fire extinguisher is a recent addition.*

Back page upper: *The Sub Brit group inspect one of the iconic 'Pagodas' at Orford Ness, a military test site since the WWI. The Atomic Weapons Research Establishment took up residence here in 1953, initially working on 'Blue Danube', the first British nuclear bomb. The two Pagodas were part of a later programme to determine the resistance of nuclear weapons to extreme handling conditions, in this case vibration. The structure was designed to absorb accidental detonation of the conventional explosive contained in these weapons: no nuclear material was involved in these tests. Photo Clive Penfold*

Back page lower: *Sub Brit members emerging from the south portal of Tunnel Road, Reigate in February 2022 after a successful visit to the Reigate Caves. Inside the tunnel, the East Caves are to the right and the West Caves to the left. Tunnel Road was built in 1823 to provide a short cut on the main London – Brighton Road. It was pedestrianised in the 1970s. Photo Clive Penfold*

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However the Editor reserves the right not to publish material without giving a reason.

The committee of Subterranea Britannica and the Editor do not necessarily agree with any views expressed and cannot always check the accuracy of any material sent in.

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Chairman's Welcome

Tim Wellburn

In late 2021 we celebrated the beginning of a return to normality with Sub Brit's first outings post-Covid – a visit to St Leonard's air-raid shelter in west London, and then our Autumn Day Meeting and associated visits. For 2022 we were determined to pull out all the stops to get back out, about and underground with a vengeance. Looking back on the past year, I think we achieved that.

We kicked off in February with a visit to Reigate Caves, hosted by our friends Wealden Cave & Mine Society. A particular highlight was the splendid new 17-metre tunnel, excavated with the help of a Sub Brit grant, in order to allow continued public tours of the Tunnel Road West Caverns.

On a sunny but still chilly day in early March, we assembled at Stockwell's Grade II* listed bus garage for a wonderful Routemaster trip around some of London's quirky underground vents – *Subterranea* 59 has details and pictures.

This was followed, a fortnight later, by a visit to the Courtauld industrial air-raid shelters at Halstead in Essex, at that time under serious threat of having the central third of its unique Costain shelter group destroyed by a developer. Fortunately, the efforts of Halstead 21st Century group, supported by other objectors (including Sub Brit), eventually prevailed, the planning application being rejected by Braintree District Council in October.

Maidstone Girls' Grammar School has displayed an altogether more enlightened view of its WWII heritage, embarking on an ambitious educational project which saw the reopening of a long-lost second air-raid shelter, This work was undertaken by Kent Underground Research Group and supported by a Sub Brit grant. The School kindly invited us back in April to see what had been achieved. While in the vicinity, we took the opportunity to visit Hollingbourne Auxiliary 'Z' Station – hard to find (by design) unless you can spot the WWII radio aerial running up an adjacent tree!

We rounded off the month with a visit to Crossness Pumping Station, a 'bonus' visit following our Spring Day Meeting. We have recently agreed to provide Crossness with a grant which we hope will enable the skilled volunteers there to start the task of bringing the *Victoria* pumping engine back to steam, helping to sustain the Trust's splendid work of explaining to the public this iconic masterpiece of Bazalgette's sewerage system. We are promised a return visit to go under the floor plates to see the serious plumbing in Crossness' dark and interesting subterranean areas.

In early May a Sub Brit Expeditionary Force crossed the Channel for a five-day visit to some of the largest underground fortifications in Europe: two great Belgian forts, Eben-Emael and d'Aubin-Neufchâteau; the Maginot line gros ouvrages Fermont and Hackenberg; and petits ouvrages Immerhof and tragic La Ferté. This tour, which included an unscheduled return visit to the extraordinary V3 site at Mimoyecques, was fully reported by Martin Dixon in *Subterranea* 60.

May and June brought two visits (such was the demand!) to Orford Ness in Suffolk, both organised by Sub Brit members, with side visits to Sizewell 'B' nuclear power station. 'The Ness' is a military site with a history spanning most of the twentieth century. An account of the May visit, written by Karrie Austin, appears in this issue. In July, John Smiles and the team welcomed us back to Wartling R3 Rotor bunker – useful familiarisation for those going on to Edinburgh in the autumn.

In September, David Gordon stepped forward again, arranging a splendid triple-bill of visits to Beacon Hill Fort, the adjacent radar tower with its superbly restored array, and to Harwich Redoubt - which came complete with distant views of the Maunsell sea forts! There will be an article on this trip in the next issue.

The following month English Heritage finally gave us our long-arranged 'special interest' access to the 'Dumpy' Level complex at Dover – an extensive WWII tunnel system subsequently repurposed during the Cold War as one of UK's Regional Seats of Government. We also visited and were able freely to explore Capel Battery, retiring for refreshment at the adjacent Battle of Britain Memorial – which occupies the site of the other two Capel gun emplacements.

Mid-October brought the splendid Edinburgh Study weekend – actually a five-day extravaganza of trips and talks, all superbly organised by Sub Brit's vice-chairman Neil Iosson. For those arriving in time, this started early and sociably on Friday. Saturday commenced with Pictish carvings in the Wemyss sea caves before moving into the Cold War era at "Scotland's Secret" Anstruther R3 Rotor bunker and 28 Sector ROC HQ. We battled motorway closure traffic to get back just in time for the booked curry evening.

The Cold War chill continued on Sunday at Edinburgh's Barnton Quarry R4 where Neil had managed at short notice to secure a morning of excellent speakers to replace the proposed visit to the historic Scotland Street rail tunnel – lost to baseless 'elf 'n safety concerns. In the afternoon we were given free-run exploration of the enormous three-storey Barnton bunker.

On Monday we took to the air in a canal boat at Falkirk Wheel before finding the reassuring security of Roughcastle Tunnel. Twenty members then headed north

to Inverness for a fascinating evening visit to a WWII filter room before disappearing next day into the void of one of Inchindown's enormous fuel storage tanks. Re-emerging into the sunshine, we inspected Invergordon's WWI tank farm, followed by Fearn Airfield operations HQ, and finally the North Sutor gun batteries as the sun set over the Cromarty Firth.

All this will be written up in *Subterranea* for the next issue. The year drew to a conclusion with a return visit to St.Leonard's air-raid shelter and a guided sortie into Brompton Cemetery and its splendid catacombs – which, by luck or judgement narrowly missed Halloween.

I am very grateful to all the people who made possible this year's programme of activities - whether as hosts, organisers or behind-the-scenes facilitators.

As trailed on the Forum and elsewhere in this issue, we have seized the opportunity to make an early visit in 2023 to Regan Vest, the Danish Government's vast nuclear bunker which is opening to the public for the first time next February. An authoritative account of the bunker, and a review of the new book about it, are published in this issue.

This entailed a late switch in the destination of our planned European Study Weekend from Norway to Jutland. The full Danish programme is being worked up as we go to press and will be announced on the Forum as soon as possible.

Happy Christmas, best wishes for 2023, and I look forward to seeing many of you underground next year.

chairman@subbrit.org.uk

Subterranea Britannica

Notice of Annual General Meeting 2023

The AGM will be held on Saturday 11 March 2023
commencing at 10.00am

at Canada Water Theatre (*same venue as 2022*)
in association with the Spring Meeting

Attendance is open to all current members of Subterranea Britannica

Documents for the AGM will be available on our website at *www.subbrit.org.uk* at least 28 days in advance of the meeting. An email will be sent to advise this Documents will be sent to those members who have registered to receive them by post

Booking will be via the website at *www.subbrit.org.uk/events* Please ensure you register in good time, which will help us with numbers and logistics

Minutes of the AGM 2022 held last April were printed in ***Subterranea*** *60*

**** Location of venue ****

Canada Water Theatre (within Canada Water Library building)
21 Surrey Quays Road, Rotherhithe, London SE16 7AR
Two minutes walk from Canada Water tube station
on the Jubilee Line (4 stops from Waterloo) and on London Overground

We hope to see you there!

Royal Connection

Many members will have been saddened to hear of the death of Queen Elizabeth II in September 2022. Not many will know that Her Majesty was, in fact, an occasional *Subterranea* reader.

After the publication of Martin Dixon's article on underground Windsor in edition 58 which included many sites beneath Windsor Castle, we sent a copy to Her Majesty via her Private Secretary. We were delighted to receive the following reply.

WINDSOR CASTLE

14th February, 2022.

Dear Mr. Dixon,

Thank you for your letter of 14th January, addressed to Sir Edward Young, enclosing a copy of 'Subterranea' for The Queen's attention.

I have shown your letter and the publication to Her Majesty who was grateful to receive them. As I am sure you will understand, it will not be possible to fulfil your request to undertake a visit to the South Bowe/Crown Jewel Chambers and the two Grottoes, as these areas have been abandoned long term for health and safety concerns.

I am sorry to send what I know will be a disappointing response. This letter comes to you with The Queen's warmest good wishes.

Yours sincerely,

Matt Magee

Matt Magee
Assistant Private Secretary to The Queen

A. Martin Dixon, Esq.

SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events

2023

Sub Brit specific events

10 January Mail Rail walk No. 5

1 March Copy Deadline for Subterranea 62

11 March Sub Brit Spring Meeting and AGM,
Canada Water Theatre, London SE16 7AR

12 March Repeat visit to Brompton Cemetery Catacombs

15 April Subterranea 62 published

18 April Mail Rail walk No. 6

21-24 April Sub Brit Europe Weekend – Denmark

Other trips are in the pipeline, but not firmed up yet

Other Underground related events

August 2023, NAMHO, Cumbria

September 2023 Hidden Earth Association (BCRA) annual caving conference
Dates and venue to be confirmed

For up to date information about these events
please visit www.subrit.org.uk/events
or contact the organisation concerned

If you know of other relevant events run by other societies, please let us know so that they can be advertised in the next edition and on the website

2023 Study Weekend
Jutland, Denmark

Friday/Monday 21–24 April 2023

Contrary to all our planning to date to resurrect the Norwegian Study Weekend – which we lost to Covid in 2020 – our European travels in 2023 will now take us back to Denmark!

This late switch of country is to exploit the fact that access to the Danish Government's Cold War bunker REGAN VEST – described elsewhere in this issue – will become possible in early 2023. Lars Hansson, our Sub Brit member based in Sweden who does most of the leg-work for our Scandinavian forays, has established contacts there and proposed we get in early – we agreed!

The Norwegian study weekend is not lost – it is merely further postponed, perhaps to 2024.

Lars is now having to restart detailed trip planning for Denmark, so we do not yet have the logistical or cost information that we would normally publish at this stage. However, we are working to the above dates – so save them in your diaries!

We propose to base ourselves in Ålborg, which is in northern Jutland, and make excursions from there to Regan Vest and to other sites.

The other sites currently under consideration range from WWII gun batteries to a limestone mine and may include:

- Ω A civil defence command bunker in Hadsund
- Ω German coastal artillery batteries in Frederikshavn, Hirtshals and Hanstholm
- Ω Parts of the Atlantic Wall at Vigsö beach
- Ω A limestone mine close to Regan Vest

Ålborg also has a defence museum *https://formarsmuseum.dk* as well as a maritime museum *https://springeren-maritimt.dk/*

The confirmed programme will be posted on the Forum as soon as it is finalised. Booking for the weekend will open early in 2023 and we will give advance notification of that by email.

Please note that all attendees must be members of Sub Brit for insurance purposes, so be sure to renew your membership promptly. Members under the age of 18 must be accompanied by a parent or guardian. You will need a reasonable level of fitness in order to participate in the weekend. General conditions for Sub Brit weekends can be found on our website.

A non-returnable deposit of £50 will be payable at the time of booking. As usual, **you will be responsible for your own travel to and from Denmark** but please do not arrange flights or other arrangements until you have a confirmed place.

MEMBERSHIP RENEWALS 2023

For many members of Sub Brit, your membership year will end at the end of December, and it will thus be time to think about renewing. Not everyone though – for more recent joiners, your membership ends on the anniversary of your joining. You will get an automated renewal reminder from Sub Brit's system. We'd be very pleased to see as many members as possible rejoining the society for 2023.

After the hiatus caused by the pandemic in 2020 and 2021, it felt like 2022 was a bit of a return to normal. We were able to hold our Spring Meeting in person in London, at our fine new venue of Canada Water Theatre, and it was great to see a good number of attendees. This was alongside our AGM, where we said goodbye to some old committee members, and welcomed some new. The AGM was followed on the Sunday by a special visit to Crossness pumping station.

We also managed to run a good number of other trips and visits in 2022, among them:

- Five-day tour to the Maginot line in May
- Five days of visits in Scotland in October
- Two trips to Orford Ness
- Trips to
    - "Inventive Vents" bus tour in south London
    - Harwich fortifications
    - St Leonard's air-raid shelter, west London
    - Dover's Dumpy level (after several postponements!)
    - Reigate caves
    - Brompton Cemetery catacombs

And several others – we've been busy! We hope you managed to get to one or more of these excursions – or at least read about them in our *Subterranea* magazine.

There were our usual three issues of *Subterranea* produced – all in full colour and with the usual number of pages. Well done to Nick and the team for these. The effort to put many new sites on our website is ongoing – but more would be welcome! Please do get in contact if you have somewhere you'd like to see featured.

We look forward to welcoming you back next year when we hope to continue a busy schedule – running many of our usual live events, starting with our AGM and Spring Meeting in March.

We are always looking to boost our membership, to help with economies of scale – so if you have any friends or relatives who might be interested, please encourage them to join. And **remember** that this will be the last edition of ***Subterranea*** that you will receive, if your membership expires at the end of December, unless you rejoin.

To rejoin, go to the main SB website, click on 'Menu' at top right and select 'Membership'

Spring Meeting 2023

Saturday 11 March 2023, commencing at 10.25am, following the AGM

at Canada Water Theatre *(same venue as 2022)*

Why not come along to our Spring Meeting in 2023? This annual event is an opportunity to meet with other Sub Brit members and swap stories of underground visits. You may also bump into like-minded people and arrange to make a site visit together.

During the day there will be three to four talks by knowledgeable speakers on underground topics. In recent years we have had speakers on Albania's mushroom-shaped Bunkers, the Rhondda tunnel, Catesby Railway tunnel restoration and reuse, and Barnton Quarry's bunker restoration project. We usually also have a couple of quick updates from members on places they have visited. Speakers will be advised and the full Programme will be published on the website nearer the time.

The day will start with tea and coffee followed by the **Annual General Meeting** of Sub Brit, then we'll launch into presentations from our speakers. A buffet lunch is available for all, and refreshments/tea/coffee will be served part way through the afternoon.

Booking will be at ***www.subbrit.org.uk/events*** and will be available early in the New Year. This will be advertised on the Members' Forum and by email.

Please make a note of the date in your diaries now, and then please make every effort to book in advance, as latecomers make logistics and catering more difficult. Attendance at the Spring Meeting is open to all current members of Subterranea Britannica and to friends and relatives – so please do let your colleagues know and why not bring them along.

Cost for the AGM and Spring Meeting is expected to be £29 per person which will include refreshments and the buffet lunch. Attendance at the AGM only is free of charge.

****** details of venue ******

Canada Water Theatre (within Canada Water Library building),
21 Surrey Quays Road, Rotherhithe, London SE16 7AR
Two minutes walk from Canada Water tube station
on the Jubilee line (4 stops from Waterloo) and on London Overground

How to Organise a Sub Brit Site Visit – Useful Notes

A useful checklist is the acronym AIRPORT:

Approach the owners

Insurance needed?

Risk Assessment

Participants

On the Day

Record the site

Thankyou

Approach the Owners

Once you've identified the site owner it's best to start at the top and talk to them in person. A follow-up email is useful to confirm understanding and lets your contact forward the information internally. Check whether there is a limit on numbers.

It's worth offering to meet the owner's out-of-pocket expenses, or make a donation to their chosen charity, which you can cover by making a charge for the visit.

Please don't claim to represent Subterranea Britannica without first getting the agreement of the Committee.

Insurance

Some site owners may want the visit to be covered by Third Party Liability Insurance. Subterranea Britannica holds this insurance but it applies **only** to 'official' visits and is valid **only** for Sub Brit members. 'Official' means that the Committee has approved the visit in advance, so if insurance is a requirement, please talk to Dave Maguire at an early stage.

Note that Sub Brit's Third Party Insurance is not personal accident insurance, which remains the responsibility of individual attendees.

Risk Assessment

It is generally sensible to make a risk assessment of the site – and this is mandatory for Sub Brit official visits. This enables you to brief participants on any risks and how to avoid them. It will also help you identify any protective equipment that may be needed, and any accessibility issues – which are helpful to flag up when you announce the trip.

There is a suggested risk assessment template on our website at :

www.subbrit.org.uk/docs/site-risk-assessment-form.pdf

Ensure the exact location of the site is known in case emergency services need to be called. It may be useful to know the location of the nearest hospital with an A&E department.

For a large or complex site, provide paperwork and insist that attendees sign in and out.

Participants

Attendees will need 'joining instructions'. These can be sent via email and/or posted on the Forum and should cover:

- Date, time and duration of visit.
- Location and where to meet. Postcodes can cover a wide area in rural areas so it may be helpful also to provide a grid reference and/or 'what3words' location
- Equipment needed (helmets, boots, gloves, torches etc)
- Risks that you have identified and how attendees can best avoid them
- Any restrictions on the visit – eg photography; escorted or free access etc
- On-the-day contact numbers in case of travel or other problems
- Ideally, a link to site information & a site plan so attendees can get the most out of their visit.

On the Day

- Collect any donations, as required
- Brief attendees on the potential risks of the site
- Remind them of any visit restrictions
- Reiterate timings
- Count/sign people in and out, if necessary

Record the Site

If the site is not fully recorded on the Sub Brit website, try to document it.

Try to find somebody to write up the visit for *Subterranea* (or do it yourself and claim the credit!). Dave Maguire can organise sub-editing and polishing for publication.

Thankyou

Don't forget to thank the owner profusely after the visit. If the visit is written up in *Subterranea* we can provide a copy/copies of the magazine for you to send on to them.

Finally, if you want any help – or wish to run the trip as an official Sub Brit visit – email dmaguire@subbrit.org.uk and he will try assist you along the way.

Summary Minutes of Committee Meeting on 16 July 2022

The meeting was held online, which works well for us, as we are distributed across the country.

Participating Tim Wellburn (in the Chair), Linda Dixon (secretary), Martin Dixon, Neil Iosson, James Buller, Dave Maguire, Richard West.

Apologies from: Tony Radstone, Phil Catling, Richard Seabrook, Jay Curtis (now on sabbatical)

Matters arising from Reports Most of the Committee reports were posted to the Forum and discussed in the meeting.

- **Grants** – Tim will now take over administration from Jay Curtis.
- The **AGM** and **Spring Meeting** were successfully held on 23 April at Canada Water Theatre. There was an issue with the amount of lunch delivered – the caterers forgot to deliver the last trolley, for which compensation and apologies were received.
- The production of ***Subterranea*** is now run by a whole team – Editor, commissioning editor, proofreaders, committee notices, mailings etc. Tim has written a guide to ensure we all know what to do and when.

Spring Meeting and **Annual General Meeting 2023** It was agreed that we would again hold this at Canada Water Theatre in London. Linda will coordinate a date and book the venue.

Membership Questionnaire We will publish an article on our agreed actions in *Subterranea* 60.

Autumn 2022 The weekend in Edinburgh around 15–17 October will go ahead, coordinated by Neil. Bookings are now open – well done for all the effort so far.

Trips and visits The tour to the Maginot Line, in association with Leger Holidays, was held successfully in May. The Wartling bunker visits on 9 July also went well, along with several other day trips in Spring. Other trips are in the pipeline e.g. Beacon Hill Fort & Harwich Redoubt on 24 September, Dumpy Level at Dover on 1 October.

Next Committee meeting To be arranged, online.

NEWS

Miscellany compiled by Nick Catford

NEWS – ARCHAEOLOGY

Archaeologists believe they 'may' have found Cleopatra's tomb

A Tunnel carved through layers of rock has been discovered beneath Egypt's ancient Taposiris Magna Temple, which may lead to the long-lost tomb of Cleopatra.

The tunnel, which is being hailed as a 'geometric miracle', stretches for more than 4,800 feet, measures about six feet high and is said to resemble the Tunnel of Eupalinos on the Greek island of Samos – revered as one of the most important engineering achievements of the Classical world.

Archaeologist Kathleen Martinez of the University of San Domingo has been convinced for more than a decade that Egypt's last pharaoh Cleopatra and her lover Mark Antony were laid to rest within the temple, and is sure the tunnel could be the path to this discovery. The Taposiris Magna Temple, whose name means 'great tomb of Osiris', is located near the Egyptian city of Alexandria, once the country's capital.

Martinez said there's a good chance the queen is buried there and if she is, finding the remains of Egypt's last pharaoh would be 'the most important discovery of the 21st century. If there's a one per cent chance that the last queen of Egypt could be buried there, it is my duty to search for her.'

This is the first time that any archaeologist has found tunnels, passages underground [and] inside the enclosure walls of the temple, and this has changed forever what they know about the architecture. The archaeologist believes that, after Mark Antony killed himself following his defeat to Caesar Augustus, Cleopatra put detailed plans in place for them both to be buried there, in echoes of the myth.

Cleopatra negotiated with Augustus to allow her to bury Mark Antony in Egypt. She wanted to be buried with him because she wanted to re-enact the legend of Isis and Osiris. The true meaning of the cult of Osiris is that it grants immortality. After their deaths, the gods would allow Cleopatra to live with Antony in another form of existence, so they would have eternal life together.

Martinez may now be on the right track after uncovering the tunnel carved in rock that sits about 43 feet below the temple. Teams working at the site found a part of the tunnel that was submerged under the Mediterranean, a number of pottery vessels and pottery tractors were found under the mud sediment, as well as a rectangular block of limestone and a blind completion.

The research team believes that the Taposiris Magna Temple's foundation may also be underwater due to at least 23 earthquakes hitting the Egyptian coast between 320 AD and 1303 AD. Martinez also uncovered several important artefacts inside the temple including coins bearing the images and names of both Queen Cleopatra and Alexander the Great; and a number of beheaded statues, and statues of the goddess Isis, as well.

SOURCE: *MailOnline,* 8 November 2022

Burial cave from the time of Ramses II discovered in Israel

Archaeologists have found an intact burial cave containing dozens of artefacts that date to the time of the Egyptian Pharaoh Ramses II. The discovery of the space, described by officials as being 'frozen in time,' was made by accident when a mechanical digger hit the roof of the structure at a beach spot in Palmahim National Park.

The burial site contains dozens of pieces of intact pottery and bronze vessels, jars and bowls of various types, cooking vessels and oil lamps. There were also very small vessels that had held tiny amounts of precious substances. Some tools of war, such as arrowheads and bronze spear tips have also been unearthed.

Eli Yannai, an expert on the Bronze Age at the Israel Antiquities Authority, confirmed that the site contained a host of different items that were meant to serve the dead in the afterlife. 'This is a once-in-a-lifetime find,' Yannai stated. 'It's not every day that you see an "Indiana Jones" set – a cave with vessels on the floor that haven't been touched in 3,300 years. We are talking about the Late

Bronze Age. These are precisely the days of the famous king, Ramses II – the one some identify with the story of the Exodus.

'The fact that these people were buried along with weapons, including entire arrows, shows that these people might have been warriors, perhaps they were guards on ships – which may have been the reason they were able to obtain vessels from all around the area.'

Authorities believe this burial site may have served a family or clan. However, not much more about the bodies can be said. In contrast to the gravesite artefacts, the bodies' preservation was poor – meaning that DNA extraction and analysis is not going to happen. Some of the bodies had been laid on their back, while some seem to have supplanted other bodies. Researchers don't know what settlement they may have been associated with, it may have been lost to the sea over time.

SOURCE: *MailOnline,* 19 September 2022

High-ranking Egyptian noble found in burial chamber

The pink granite sarcophagus of a high-ranking Egyptian noble has been found in an ancient burial chamber near Cairo, where it has been lying for thousands of years. It belonged to Ptah-em-wia, who served as head of the treasury under Ramses the Great, and has been described by archaeologists as a 'dream discovery'.

Inscribed on all sides with emblems, hieroglyphs and titles, the 3,300-year-old stone coffin was found in pristine condition and in its original tomb 23 feet underground. Professor Ola El Aguizy, who discovered the sarcophagus in Saqqara, hopes the finding will shed light on those who ruled Egypt after Tutankhamun. The Cairo University archaeologist said: 'The hieroglyphs on the sarcophagus certify that it is Ptah-em-wia and also the titles mentioned on the sarcophagus are the same as those found on the walls of the tomb itself. It only emphasises that he is a nobleman and quite close to the king, because his titles related to the temple of millions of years in Thebes prove that he had a very important role in the administration of that time.'

The surface-level tomb was discovered by Professor El Aguizy last year, but she was not able to descend into the underground chamber until this year. The archaeologists had to move several tons of sand to create a shaft they could use to reach the first level of the tomb, which is located near the pyramid of King Unas. There they found 3,000-year-old stone masonry, which had to be reinforced before they could safely descend any further.

It had a small hollow in the floor hiding a second shaft, which the team descended by sitting in a large metal bucket that had to be winched up and down by hand. This second underground level was the burial chamber, and was where the sarcophagus was lying. Finding the coffin intact and in the tomb of its original owner are both rarities in Saqqara.

While it was found in good condition, a part of its lid was broken off and had been left in the corner of the room. The archaeologists claim this was the result of tomb robbers breaking open and looting the casket. Tomb robbers were active in the area in ancient times, and most tombs were then reused several times over so not many of the original owner's belongings would remain there.

However, Ptah-em-wia was the original builder of the tomb where his sarcophagus was found. His coffin shows a record of all his titles, including Great Overseer of the Cattle and Royal Scribe. He headed the treasury of Egyptian pharaoh King Ramses II in the era following the death of Tutankhamun.

Professor Ola El Aguizy who discovered the sarcophagus in Saqqara, hopes the finding will shed light on those who ruled Egypt after Tutankhamun

Professor El Aguizy said: 'This sarcophagus is a good example of New Kingdom style of sarcophagi for the elite. It is in granite and is inscribed with usual emblems of the gods: the Sky-goddess Nut on the lid covering the chest with her opened wings to protect the deceased, the four sons of the Sun-God Horus surrounding the sarcophagus with prayers for the protection of the deceased. The features of the face and the beard reveal also the nice artistic features of the New Kingdom art, and the high rank of the deceased.

Professor El Aguizy's team will now study the sarcophagus fully to uncover the whole story of Ptah-em-wia's life.

SOURCE: *MailOnline,* 4 October 2022

King Tut's tomb might reveal more treasures

More buried treasure may be found behind the tomb of King Tutankhamun, according to new research on its hieroglyphs. Howard Carter became the world's most celebrated archaeologist when he led the team that discovered the 3,000-year-old tomb in the Valley of the Kings in 1922.

The Tutankhamun expedition, funded by Lord Carnarvon, found more than 5,000 objects. Treasures included the pharaoh's solid gold coffin, multiple thrones, furniture, food and wine. However, a newly revised book by fellow archaeologist Dr Nicholas Reeves has suggested that Tutankhamun's tomb is only an antechamber.

He has said that a larger sepulchre may be hidden behind it – leading to the resting place of Tutankhamun's

stepmother Queen Nefertiti. Dr Reeves claimed, 'The greatest archaeological discovery in the world has got more to give – potentially something far more impressive than Tutankhamun's burial. I'm suggesting that the most famous woman in the ancient world is also buried there.' Carter believed many of the items buried with the pharaoh had been stolen before he discovered the site a century ago.

Carter is seen in October 1925 with an Egyptian workman as they examine Tutankhamun's innermost coffin made of solid gold, inside the case of a second coffin

The tomb's outer entrance bore signs of forced entry, with experts at the time concluding that two break-ins had occurred soon after Tut was laid to rest. The robbers only took away smaller, portable items, though it is since believed that more than half the royal jewellery was taken. When they were first discovered, many of the objects were found to have been arranged in a jumble – where they had lain untouched for more than 3,000 years.

But it still took Carter more than 10 years to document all the treasures that remained buried with Tut. Meanwhile, if Dr Reeves' is correct, the items buried with Nefertiti will remain completely untouched since her burial. Nefertiti ruled over what some scholars say was the wealthiest period of ancient Egypt, where the empire flourished, in the 14th century BC.

One of ancient Egypt's most influential Queens, ruling during the empire's prosperous 18th Dynasty, she was either the mother or stepmother of the boy-pharaoh King Tutankhamun. Her full name, Neferneferuaten Nefertiti, means 'Beautiful are the Beauties of Aten, the Beautiful One has come'. Dr Reeves developed his theory in 2014 after studying scans of the walls of Tut's tomb, before identifying what he believes are two sealed doorways. He has suggested that one leads to a storeroom and the second to Nefertiti's tomb.

This, he says, implies that the cartouche shows Tutankhamun burying Nefertiti as the tomb was originally part of her burial place. The first cartouche depicts Ay's birth name, but Reeves suggests there are traces of the shape of a reed leaf. He said: 'This hieroglyph is the first character of the divine component of Tutankhamun's name in all standard writings.'

The second cartouche, he adds, shows three scarab beetles and appears to say 'Kheperkheperure' – the misspelt throne name of AY. The archaeologist suggests that, before the alteration, it would have looked slightly different with an extra shape. This, he says, would have made it a rare but accurate spelling of Nebkheperure – Tut's throne name. Dr Reeves believes the court was unprepared for Tut's early death aged just 19.

The ten weeks to prepare his body for burial would not have been long enough to build a new tomb, he adds. Instead, he suggests they improvised and placed Tut in a burial chamber in the front hallway of Nefertiti's burial chamber. Dr Reeves believes the odds Nefertiti lies behind Tut's burial place are slightly better than 50/50.

SOURCE *MailOnline,* 5 November 2022

NEWS – CONSERVATION AND HERITAGE

Historic railway site in Liverpool gets heritage protection

What is said to be the cradle of railway travel has been earmarked as a nationally important archaeological site after a long campaign. The government recognition for Edge Hill Engine Station in Liverpool crowns 40 years of work by volunteers.

Opening in 1830 as the first locomotive terminus, it was a key moment in the development of mainline railways. Its selection as a protected site was based on a recommendation made by Historic England. Edge Hill was where steam locomotives were detached from trains arriving from Manchester, with ropes hauling passenger carriages up inclines to the Crown Street passenger terminus and lowering goods down to the docks at Wapping.

The rarity of the surviving remains of the rope-winding arrangement for the Wapping and Crown Street inclines adds to the location's national significance. The opening of the Liverpool and Manchester Railway on 15 September 1830, engineered by George Stephenson, is regarded by many as the birth of modern mainline railways. When members of the Merseyside Industrial Heritage Society and colleagues from Liverpool museums cleared rubble and rubbish from the Edge Hill cutting in the late 1970s, they identified the various trenches through which the rope haulage system operated.

Now, over 40 years later, they are pleased to find their work has also been an impetus for the site being awarded national protection. Historic England said the quality of the evidence about Edge Hill's archaeological significance which had been gathered by rail enthusiasts was key to the designation granted to it by the Department for Digital, Culture, Media and Sport.

The application which has now led to the site's addition to the National Heritage List for England as a scheduled monument, was first made in 2018 by the Liverpool and Manchester Railway Trust, which collated 19th-century documents and produced an analysis of the archaeological

Edge Hill cutting during the Sub Brit Liverpool weekend in 2012.In the distance Wapping tunnel is seen in the centre with the 1829 Stephenson tunnel to the right. Photo Nick Catford

excavations in the 1970s. For over forty years, the Trust wanted to see the site given the recognition it deserves as the starting place of the world's first inter-urban railway.

They would now like to see work undertaken to clear damaging vegetation and for the station site to be included in plans for the celebration of the 200th anniversary in 2030 of the opening of the railway, including some provision for visitor access to the site.

The site has a large amount of underground content. Steam for the winding engine was supplied from a boiler in the Edge Hill cutting through a long tunnel excavated through the sandstone on the north side of the cutting; this was known as the 'steam tunnel'; the boiler was housed in a chamber cut into the cutting wall. A number of openings cut into the rock face can be seen on each side of the cutting. All those on the south are some three metres shorter than when originally excavated following the widening of the cutting in 1864.

On the south side the two easternmost openings are 12.6 metres deep and although there is no documentary evidence to confirm what they were used for, it seems likely that they housed two of the boilers for the south engine. The bays are joined together at the rear by a short tunnel and there is also a link to the smoke flue feeding the southern chimney.

At the western end of the cutting three railway tunnels enter the west wall of the cutting. The northernmost (the 'Stephenson' tunnel) to Crown Street and the central one to Wapping date from the opening of the line while the southernmost tunnel was driven through an original storage recess in about 1846 and was further opened up when the south cutting wall was cut back by three metres after 1864 to accommodate an extra track.. Of the three tunnels the Stephenson tunnel is the smallest, being 5.15 metres high to the crown of the arch, and 4.60 metres wide.

At the far end, which is now blocked, there is a date stone of 1829 set into the roof. There is also a hole in the floor dropping down into the roof of the Wapping Tunnel. The tunnel is cut through solid rock and unlined with brick arching; internally it is in good condition with a large quantity of long stalactites hanging from the roof. The site was visited during the Sub Brit Liverpool weekend in 2012.

SOURCE: *BBC News,* 27 August 2022, and Sub Brit website

Tunnel under Niagara Falls opens to the public

A whitewater wonder visited by everyone from Marilyn Monroe to Mark Twain, Niagara Falls has been a magnet drawing global travellers for at least two centuries. But until this year, a huge tunnel buried deep below the cascade has been off-limits to visitors. The rocks beneath the gigantic triple waterfall that straddles the border between the US state of New York and Canada's province of Ontario are honeycombed with chambers carved out to harness the powerful forces of nature thundering overhead.

The 670-metre tunnel was carved out of the rock more than a century ago

And now, a 2,198-foot tunnel built more than a century ago on the Canadian side has been opened up to reveal the awesome scale of these engineering marvels. Since July 2022, it's been part of tours of the decommissioned Niagara Parks Power Station tour which began a year earlier. Exploring it offers a fascinating glimpse into pioneering work that helped bring this corner of North America into the modern age.

The power station, which operated from 1905 until 2006, diverted water from the mighty Niagara River to run giant generators that electrified regional industry and contributed to the nearby Great Lakes port of Buffalo becoming known as the City of Light. The region around the waterfall was once a hub of activity for businessmen who wanted to cash in on harnessing hydro power.

The Adams hydroelectric power plant was the first to open, operating on the US side from 1895 to 1961. On the Canadian side, the Ontario Power Company operated from 1905 to 1999, and the Toronto Power Generating Station from 1906 to 1974.

Today, the Niagara Parks station is the world's only fully intact hydroelectric plant of its era. Originally operated by the Canadian Niagara Power Company, it used Westinghouse generators to create alternating currents patented by inventor Nikola Tesla -- cutting-edge

technology at that time. The plant was built at a time when aesthetics ruled. Its rustic limestone exterior and blue roof tiles were an attempt by New York architect Algernon S. Bell to make the structure blend in with the falls.

Before reaching the tunnel, visitors to the power station are shown a scale model of the massive engineering works that went into converting the pounding waters into electricity. Visitors can see where the water came in, where it ran down a shaft to power the turbines, and then where it went through a tunnel to a discharge point at the base of Horseshoe Falls, the largest of Niagara's three cascades.

The tunnel has been part of the tourist route through Niagara Parks Power Station since 2021

The plant started out with two generators and, by 1924, all eleven were installed, which are seen today. Beside every generator is a 'governor' which regulated the water flow to a turbine. An air brake in the governor helped adjust the flow. They needed 250 rpm exactly to give them 25 hertz. A glass elevator takes visitors down 55 meters past the six levels of infrastructure required for the hydro power generation process. At the bottom is the tunnel where the water would exit.

The tunnel, which is almost eight meters tall and six meters wide, is also an historic, one-of-a-kind attraction and is included in the power plant's price of admission. It took thousands of workers four years to excavate the shale beneath the main generating room using lanterns, dynamite, pickaxes and shovels. On its way down, the water would spin the turbine blades which were connected to a 41-meter-long shaft that went all the way back up to the main floor and spun the rotor in the alternator, generating the AC power. A visit to the power station and tunnel takes around two hours.

SOURCE: *CNN,* 2 November 2022

Air-raid shelter at Brighton school wants to attract more visitors

A new staircase entrance to an underground air-raid shelter in Brighton will enable more people to experience what life was like during the Second World War. Until now, Take Shelter, underneath Downs Junior School, in Ditchling Road, could only be reached via its old cramped hatch and steep metal ladder.

Now, a five-year fundraising campaign by volunteers has resulted in a wider flight of steps and handrails. For some people the original entrance consisting of a hatch and a ladder was either too off-putting or it was not even possible for them to enter the shelter. This meant they missed out on experiencing the air-raid shelter and what it was like in wartime Brighton.

Now people of all ages and abilities can access the lower level via the new steps much more easily. It's already proving a big success. The shelter, built in 1939, is made up of a series of interconnecting tunnels made from pre-cast concrete panels, about three metres below the playground. It had a capacity for 300 pupils and staff during the day and the local community at night. After the war, the shelter was sealed up and forgotten about until a drain inspection in 1983.

The new entrance to the air-raid shelter

In 2012, the shelter was restored by a team of volunteers and it reopened as a museum in 2016. Take Shelter holds photographs, wartime scenes and poignant film and sound clips, including a realistic simulation of a short air raid complete with vibrations simulating bombs dropping nearby. Take Shelter will be continuing to make improvements by consulting with a local access advisory group to hear from their lived experience how they can make further adjustments. They will also take advantage of technology to offer a much more user-friendly and interactive experience through more audio and videos, interactive and whatever new innovation comes along.

SOURCE: *Brighton & Hove News,* 7 September 2022

NEWS – HEALTH AND SAFETY

Tourists trapped 200 feet underground in Grand Canyon

In October a group of six tourists were stranded 200 feet underground at the Grand Canyon Caverns in Peach Springs, Arizona, when an elevator malfunctioned.

Firefighters with the Seligman Fire District were able to help the family of four up the approximately 21 flights of stairs to the surface. The husband of the second couple was also able to take the stairs to the surface, but decided to return to the cavern to stay with his wife at the motel suite located at the bottom of the caverns until the elevator became operational again. That couple took the elevator back to the surface the following day.

Grand Canyon Caverns. Photo Michael Kappel

The Grand Canyon Caverns is a tourist attraction that allows visitors to tour inside an ancient underground cave, dine and stay in a motel.

SOURCE: *CNN,* 26 October 2022

Turkish coal mine explosion kills at least 22 people

An explosion inside a coal mine in northern Turkey has killed at least 22 people as rescuers tried to bring dozens of others trapped inside the mine to the surface. The explosion occurred at the state-owned TTK Amasra Muessese Mudurlugu mine in the town of Amasra, in the Black Sea coastal province of Bartin.

Energy minister Fatih Donmez said a preliminary assessment indicated the explosion was likely caused by firedamp – a reference to flammable gases found in coal mines. There were 110 people in the mine at the time of the explosion, interior minister Suleyman Soylu said. Most of the workers were able to evacuate following the blast but 49 were trapped in a higher risk area of the facility. It was later announced that 22 people were killed in the blast.

Several rescue teams were dispatched to the area, including from neighbouring provinces. President Recep Tayyip Erdogan announced he was cancelling a planned visit to the southeastern city of Diyarbakir and would travel to Amasra instead to coordinate the rescue operation. Emergency services have rushed to the scene, along with desperate family members, and multiple miners have been seen being lifted into ambulances on stretchers. Paramedics were pictured appearing to perform CPR on casualties as they rushed them into waiting ambulances.

The private DHA news agency quoted one worker telling Governor Arslan that he came out of the mine by his own means. He described feeling a 'pressure' but said he could not see anything due to the dust and dirt.

Turkey's Maden, the mining workers' union, initially attributed the blast to a build-up of methane gas, but it has since been claimed it was related to firedamp. But other officials said it was premature to draw definitive conclusions over the cause of the accident. The blast occurred moments before sunset and the rescue effort was being impeded by the dark.

Most initial information about those trapped inside was coming from workers who had managed to climb out relatively unharmed. The Maden union estimated that some 100 workers were underground at the time of the blast. Rescuers sent in reinforcements from surrounding villages to help search for signs of life.

SOURCE: *MailOnline,* 14 October 2022

Ten Mexican miners trapped by inundation

On 3 August ten coal miners became trapped in Pinabete mine in Mexico's northern Coahuila state when a tunnel wall collapsed allowing water from adjacent flooded workings into the mine. The mine opened in January and was being worked in a 'responsible' way, according to officials. By 8 August over 400 people including divers from the Mexican Special Forces were on site working to free the miners. However, relatives of the trapped miners were growing increasingly desperate after authorities refused to allow anyone into the mine, claiming it was too dangerous to send in anyone while the water levels are still very high.

On 8 August the water was being pumped from the three 60m-deep flooded shafts at a speed of 350 litres a second and the levels were going down. A special underwater drone carrying a camera was lowered into one of the shafts, but failed to reach the depth at which the miners are believed to have become trapped. It was also hampered by a great number of solid obstacles and turbulence in the water, which severely limited visibility.

By 14 August more than 200 million litres of water had been pumped from the shafts and the water level had dropped to a depth of 5ft. It was hoped that this would allow rescuers to enter the mine safely. It was believed that the missing miners might be safe within an air pocket

or area of the mine above the flood waters. Unfortunately, before the rescuers could make any progress the water level in the three shafts at the mine suddenly rose by 65ft.

It is thought that the water is probably flowing into the mine from a nearby disused mine. Engineers are trying to access the old working to find the source of the 'leak' so they can block it. On 26 August, Mexican authorities announced, to much criticism from the miners' relatives, that it would probably take between six to eleven months to reach the ten trapped miners.

SOURCE: *Below*, journal of the Shropshire Caving and Mining Club, Autumn 2022

NEWS – MILITARY AND DEFENCE

Louth ROC post in Lincolnshire goes under the hammer

A Cold War nuclear bunker near Louth that was bought off eBay on a whim nearly twenty years ago is to be auctioned off in November with the bidding starting at around £28,000. The subterranean Royal Observer Corps monitoring post lies beneath a field between the A16 London Road and Kenwick Hill and is accessed down a 14ft shaft.

If a nuclear attack happened, the volunteer observers in the post would have communicated the location of bombs and radiation levels to the military. The bunker near Louth is identical to more than 1,500 constructed around the UK from the late 1950s onwards, which were decommissioned in 1968 (half) with the rest in 1991.

The bunkers would have had a monitoring room full of equipment and a store room cum toilet. Mark Colledge, 64, bought Louth monitoring post from Crown Castle Communications in 2003 for £12,500. Mr Colledge said, "I used to travel down from Saltburn-by-the-Sea to spend weekends there. I just used to sit there and enjoy it. Eleven or twelve years ago was the last time I visited. I see from Google that the conifer trees I planted are now about 15ft tall around the compound. I planted a few fruit trees also."

Mr Colledge said it is now time to sell and that the auction guide price is expected to be in the region of £28,000. He said, "I'm hoping to make enough to get rid of it and go on holiday. There are a lot of people who see these bunkers as collectible items – maybe there's someone

Louth ROC post in 2003, shortly before it was sold to Mr. Colledge. Photo Nick Catford

else experiencing the male menopause who would like to buy mine."

He added, "I just saw it on eBay and bought it on a whim. I think I was going through the male menopause. There was a choice of several bunkers but this one had the only access for vehicles – normally with bunkers you can only walk over land to get to them. I put a camouflage caravan on the site so I could have a hot shower."

Louth was one of 55 ROC posts sold by Crown Castle Communications in 2003. The post was one of a large number of posts bought by Millennium Communications in 1993 for use as cellphone sites. Many of these sites had planning permission refused and remained unused for ten years before being offered for sale.

Sub Brit's Nick Catford was employed by Crown Castle to visit all the sites (from north of Scotland to Cornwall), open them (by cutting padlocks off if necessary), photograph them and fit new combination padlocks. Prior to the eBay sale there were public open days run by a Sub Brit member.

SOURCE: *Lincolnshire Live,* 12 October 2022

South Korean professor builds his own shelter

Since the Korean War ended in 1953 with an armistice rather than a peace treaty, Seoul has remained technically at war with Pyongyang, and both sides routinely accuse each other of "provocations" that could tip them back into open conflict.

South Korea has a first-class shelter system for the military, but the provision of civilian shelters lags far behind. Pyongyang conducted its first nuclear test in 2006, and leader Kim Jong Un has recently ramped up work on weapons programmes banned by the UN, including staging drills it claimed simulated showering South Korea with tactical nukes.

Although Seoul's military maintains what it calls an "utmost readiness" for an attack, most civilians have forgotten the war and are not prepared. South Korea has a network of more than 17,000 bomb shelters nationwide, according to interior ministry data, with over 3,000 of them in Seoul.

The city's subway stations double as public air-raid shelters but they are not nuclear-safe. In the 1970s, the country had a law requiring buildings over a certain size in major cities to have a basement, which would serve as a bunker in war. But in Seoul, due to soaring property prices, most private buildings have converted those basements into parking space.

Mr Lee at the entrance to his bunker

This has Lee Tae-goo, a mild-mannered professor at Semyung University, concerned. Lee's 'model' bunker cost around 70 million won ($48,000) – excluding labour costs – to construct, which was covered by a ministry of education research grant that he applied for and won. He said he hopes it will inspire others to follow suit, adding that he has had many enquiries about his blueprint, including from officials from South Korea's Air Force, who inspected his bunker earlier this year.

For urban high-rise apartment dwellers, Lee recommends retro-fitting basement parking lots to double as bunkers, and says the government should nuclear-proof subway tunnels. One local company, Chumdan Bunker System, started selling nuclear-proof bunkers at a Seoul showroom in 2017, the year that Kim conducted his last nuclear test.

Chumdan's website advertises 'an underground bunker capable of withstanding nuclear explosions, radiation, chemical agents'. But the company said recently that while they were seeing growing interest in their products, this had not yet translated into sales growth. 'There has been an increase in online traffic to our website but the number of actual orders remain the same'.

Lee said people who construct nuclear-proof bunkers prefer to keep them secret, fearing they will be inundated with requests from friends, family and neighbours for shelter during an emergency. 'Even when I built this bunker, all these people were telling me they'd come if the country comes under attack. But this place can only fit 12 people,' he said.

SOURCE: *France24 News,* 27 October 2022

Large German Cold War bunker offered for sale on eBay

A German Cold War-era nuclear fallout bunker with 10ft-thick concrete walls has gone on sale on eBay for nearly £1.4 million.

The 850-square-metre apocalypse survival shelter is located in the town of Xanten, in the western German state of Nord Rhine-Westphalia and is up for grabs for the cool price of €1.6million (£1.39million).

The eBay classified ad, which has made headlines in Germany, says: 'In the middle of beautiful Xanten is a highly secure haven for you, which will withstand the challenges of protecting a family under the most extreme conditions. The huge bunker system extends underground for 850 square metres [9,150 sq ft] and convinces with the protection of its three-metre-thick concrete walls.

At the time, the bunker was used for various operations by the Bundeswehr [the German Armed Forces]. 'Sitting on 8,000 square metres of land – reportedly buildable with the right permits – the fallout shelter comes with a generator, an electrical system, a control panel, water and oil tanks, its own sanitation system, hefty steel doors and a warehouse,' according to the advert.

The estate agents also say: 'The technical facilities and atmosphere of the bunker will take you straight back to an earlier time that few can speak of.' They also said that it is a very good option for 'security' in the 'event of a war in Germany'.

Other potential uses for the place include as a 'paintball facility' or for 'commercial operations'. But it might need a coat of paint, with the estate agent saying: 'A conversion and a change of use to create living space must be examined. The estate agents explained: 'The bunker is generally in good condition, but needs to be cleared out due to items left by previous tenants. Many of the systems would need to be overhauled and checked as the electrical connections were also severed. This facility is therefore considered to be in need of renovation. The documents include various circuit diagrams, cable harnesses, documentation, site plans and cross-sections.'

SOURCE: *MailOnline,* 5 November 2022

Lincolnshire air-raid shelter to open to the public

An air-raid shelter on a former RAF base could be opened to the public as a heritage attraction. It highlights the contribution of Polish servicemen during the Second

World War and the structure is the only surviving part of what was once the sick quarters at RAF Faldingworth, near Market Rasen.

The concrete shelter would have provided refuge for 50 men, and has an escape hatch at the far end. It could become part of a heritage project launched in 2010 by the RAF Ingham Heritage Group. The intention is for the former shelter to be included as part of an existing heritage trail, which would be available to view by appointment and on specific memorial days.

The planning application states, "There are very few remaining shelters of this type, which were manufactured by Stanton Ironworks near Nottingham." Another property, designed in the style of the former RAF quarters, would be built to support the heritage work. RAF Faldingworth was the bomber base for the 1667 Heavy Conversion Unit and No. 300 (Polish) Squadron during the war. Afterwards, it was used by 305 (Polish) Squadron and then as a resettlement camp for Polish veterans.

When RAF Faldingworth closed in 1972, the site was sold as agricultural land, with remaining buildings becoming farmhouses. Over time, the buildings suffered fly-tipping, vandalism and arson attacks, and the site was finally demolished in 2019. The application has been put forward to West Lindsey District Council by Kelly & MacPherson Architects.

Editor's note: The planning application is wrong when it says there are very few remaining shelters of this type. Stanton shelters were mass produced and a large number survive. **Late News** Planning permission refused December 2022 .

SOURCE: *Lincolnshire Live,* 27 October 2022

Repairs to Canadian Cold War bunker, Ontario

Remediation work has started at Kitchener's Cold War-era bunker, while the shelter's future is still up in the air. The work at the King Street East location is expected to take eight to ten weeks to complete. The priority is to finish weather-dependent items first, to ensure completion before the colder months.

In June, Waterloo regional council decided against repairing the bunker for $700,000. They also wanted public consultations on the matter. The shelter has water and mould damage and it isn't safe for people to go inside. The proposed repairs would have stabilized the structure and waterproofed the building.

The 5,700 square foot bunker was built in 1966 during the height of the Cold War. It was designed to accommodate 40 people for weeks, with built-in heating, water and sewage systems. A local rowing club used the shelter as storage space for 20 years. It was closed in 2018 after a hazardous material assessment indicated structural damage.

The bunker is one of Canada's largest-standing municipal Cold War-era bunkers. A heritage impact assessment has been completed, but regional councillors have not made a final decision on the bunker's future.

SOURCE: *CTV News,* 21 October 2022

Police try to stop rave in Llanberis bomb store, north Wales

In September police asked crowds of TikTok (video hosting service) youngsters to scrap a rave planned at an old slate quarry where deadly nerve gas is feared to be hidden. Invites to the illegal event due to take place tonight at the Glyn Rhonwy bomb store in Llanberis were circulated on TikTok, Instagram and Snapchat, aimed at children as young as 15.

The potential rave site dates back to the Second World War and has sealed-off quarry pits, the size of two football pitches. The site was acquired by the Air Ministry in 1939 as a top-secret store for up to 18,000 tons of bombs. But in 1942 part of it collapsed, engulfing 27 wagons that were being unloaded. The collapse buried 14,000 tons of bombs – at that time 14 percent of the RAF's entire stock. The slate quarry was later used to dispose of old and surplus bombs, bullets and grenades.

Thousands of tonnes of explosives ended up in quarry pits there, prompting a massive RAF clean-up operation that only ended in the mid-1970s. In 2016 the 'Concerned about Glyn Rhonwy' group, fighting plans for a Snowdonia hydro-electric plan, said they believed that chemical weapons including captured German nerve gas were dumped or buried at the site. A report for the developers suggested some unexploded munitions could remain buried in the former quarry, but it said German nerve gas was removed and destroyed decades ago.

In early September North Wales Police feared youngsters would go there in large crowds to hold a rave. The event,

promoted under the banner 'Project X Llanberis', was shared on TikTok and other platforms by an individual who has now been questioned by police. Police and Gwynedd Council are now warning people of the dangers of the site, urging them to stay away for their own safety.

Railway loading platform in the Llanberis bomb store in 1999. Photo Nick Catford

Inspector Arwel Hughes said, 'I am aware of a social media post being circulated on platforms such as TikTok, Instagram and Snapchat of a planned rave that was reported to be taking place at the old Glyn Rhonwy bomb store site in Llanberis. The unlicensed music event was aimed towards children 15 years and above. It goes without saying that an event of this nature is both illegal and extremely dangerous, given the numerous inherent perils that would come with it being held at such a location.'

In July 2020 during a spell of hot weather, people cooling off in the disused 'Doomwatch' quarry were warned it was a store for 18,000 tons of bombs and it's claimed World War Two nerve gas is still there. **Editor's note:** The site was safely visited by a large party from Sub Brit in 2002.

SOURCE: *MailOnline,* 10 September 2022

Wealthy Russians scramble to build bunkers

Wealthy Russians are reportedly building nuclear shelters amid concerns about how poorly the war in Ukraine is going for Vladimir Putin. Reports said that Russia's elite has access to bunkers that fit a total of 100,000 people and authorities have been carrying out checks on them. Russia's NTV channel said: "20-to-30 bunkers are bought in Moscow each week, and the trend is increasing."

SOURCE: *Daily Mirror,* 10 October 2022

Poland sees huge demand for nuclear bunkers

Poland has seen a surge in demand for nuclear bunkers with private firms saying they have been flooded with enquiries. As tensions with Moscow reach a new high and Putin threatens a nuclear strike on Ukraine, one company said they were receiving up to 20 calls per day, more than the firm would normally receive in an entire month. Another said: 'After sharing a Facebook post about the current state of civil defence systems in Poland, I received 200 messages in three days.' Meanwhile, Warsaw-based Foxden said enquiries had jumped 'several hundred percent'.

With some of the bunkers looking more luxurious than five-star hotels, Foxden, which is known for its luxury home designs, camouflage their bunker entrances and external elements and include access control systems such as encryptors, fingerprint readers and face scanners. Others include gyms and private cinemas. With higher-end bunkers starting at around £350,000 for between 50-100 sq/m, lower-end bunkers are being snapped up for as much as £30,000 for a 20 sq/m four-person shelter.

Some of the bunkers being sold in Poland look more luxurious than 5-star hotels

Designed to protect from nuclear strikes, rockets, missiles and epidemics, the bunkers which are fitted with power generators, air filters and water tanks mean people can stay underground for up to 45 days. They are also 45 times safer than standard shelters. Poland currently has around 62,000 public shelters which can accommodate around 1.3 million people – three percent of the population.

With many of these being little more than outdated relics of the past, it is thought that only a small number would actually provide protection from radiation. Earlier this year, former parliamentary deputy marshal Wanda Nowicka said: 'In Silesia the outlook is dramatic. The shelters are in an unusable condition. Investment is needed but there is no legal regulation.'

Poland's deputy Interior Minister has said the country was preparing for the 'darkest scenario' as officials begin to check how many bomb shelters 'are fit for use'. Meanwhile, local authorities across Poland's 16 provinces have been working to set up supplies of potassium iodide tablets and distribution points in case of 'a nuclear emergency' resulting from Russia's war in Ukraine.

The fears are exacerbated by reports that Belarus has ordered its troops to be tested for 'combat readiness' amid reports of Russian soldiers flooding into the country 'by the trainload'. Belarus dictator Alexander Lukashenko announced he will deploy a 'joint military task force' with Moscow – a move Minsk claims is 'purely defensive'. The combat readiness test, ordered by Lukashenko, was announced as the head of his secret service said

he expected to see a 'turning point' in Vladimir Putin's invasion in the coming months.

SOURCE: *MailOnline,* 11 October 2022

ROC Post near Peterborough is for sale

Another ROC bunker is up for grabs for just £28,000 as Putin pushes the world to the brink of WW3. The former ROC Nuclear Monitoring Post in Quadring Eaudyke, near Peterborough, is one of 1,500 spread across the UK. The bunker was bought by Philip Frostick, 56, in 1993 after it was spotted by his friend's dad in a newspaper.

He and a pal bought it with big plans to do it up – but gave up on the idea when they realised the full extent of the cost and effort it would take. While it lay abandoned for the last thirty years, it was broken into, trashed and burned – with valuables lost including an award won for the best kept bunker. But Phillip believes that it could take just a few weekends of hard work to bring it back to fighting shape. He said: "At the time it was really bought as a bit of a folly, but we never knew what it might become.

"We thought we could do great things with it – and over the years I can't lie and say that I've never dropped it into conversation. At the back of my mind it's not getting better – hopefully there will be a club or a history buff that has got a bit more enthusiasm and energy than I have to bring it back to what it would be like."

Quadring Eaudyke post in 1998. Photo Nick Catford

Many of the monitoring posts were built to a standard design consisting of a 14ft access shaft with a toilet and a monitoring room. Officers stationed at the posts would forecast which areas would be in danger from nuclear fallout in the case of an attack. The posts were built underground with many still intact nearly 70 years on from when they were first commissioned in 1955.

With a guide price of £21,000 to £28,000, potential buyers can view the bunker on Unique Property Bulletin. Russ McLean, who set up Unique Property Bulletin in 1987, says a surge of Brits are considering bunkers as tensions between Russia and the West over Ukraine continue. Many fear the crisis in Ukraine could develop into a wider armed conflict or evolve into World War 3. Mr McLean, who served in the police and also in the Merchant Navy, claims to have fielded more than 3,000 calls, emails and texts from Brits terrified by what Putin might do.

McLean continued: "There are seven bunkers we have sold in the past ten years. When Putin invaded, our clicks started going up significantly and noticeably in the two weeks that they invaded. They have never really come back down. My phone goes at least twice a day where you have a conversation with someone about nuclear bunkers."

SOURCE: *The Sun*, 7 October 2022

Hotel and leisure complex planned for Western Heights, Dover

A giant hotel and leisure centre are planned for a historic site in Kent as part of an ambitious £100 million renovation project for the 33-acre clifftop site which includes 54 buildings. Shops and cafes are also proposed for the Citadel at Dover's Western Heights, which dates back to the 1700s. It is hoped the renovation will be completed within the next six to eight years, with long-term plans also including a cycle track.

A public consultation for the brownfield site – originally a defence base to stop invasion by Napoleon's forces and later a youth detention centre – is planned in the next six months. The organisation behind the development is the landowner, Dover Citadel Ltd.

Planning permission was granted this spring by Dover District Council for the first phase of the scheme, which could see six small businesses moving into the casemates within the fort, or one single large business. A courtyard with seating is planned, while windows, toilets, heating and new lighting would be added. The work involves minimal physical alterations to the current buildings.

That part of the project was further pushed forward by a £1 million grant from the government's Getting Building Fund grants scheme. Planning applications are now expected shortly for the proposed hotel of 200 to 250 rooms, a leisure centre and cycle track. End-to-end the project is valued at £80 million to £100 million.

Aerial view of the Western Heights Citadel

The area is already home to Citadel Studios, which has regularly been used for shooting TV and film productions. Videos for the electronic music group Jungles have also been filmed there. The Citadel was also a backdrop in *Pistol,* the Danny Boyle TV show based on the life of Sex Pistols guitarist Steve Jones. That was on top of location filming at Dover seafront, Deal town centre and The Grand in Folkestone in April 2021.

The Citadel, one of the highest points in Dover, has disused buildings including prison wings, a guard room, a gymnasium and a canteen. It also has Second World War bunkers, a network of underground tunnels, officers' quarters, workshop, armoury, pump house and barrack huts.

The first recorded permanent fortifications to be established on the Citadel date from 1770. From 1804 these were vastly developed to prepare for the threat of invasion from Napoleon Bonaparte's forces from across the Channel.

The land was in continuous military occupation over 170 years, with the fortification representing one of the largest and most elaborate surviving examples of its kind for the 19th century in England. It was used for barracks during both world wars. The Citadel was transferred to the Prisons Commission in 1954 to become a Borstal and Young Offenders Institution. Most recently the site was an immigration detention centre until 2015. Dover Citadel Ltd bought the land from the Ministry of Justice in 2020.SOURCE: *KentOnline,* 25 August 2022

WWI practice tunnels found on Salisbury Plain, Wiltshire

A series of practice tunnels dating from WWI have recently been uncovered on Salisbury Plain. Constructed close to Larkhill Camp, they are part of a large number of trench networks created on Salisbury Plain for troop training during 1914–18. Almost every camp had a system of practice trenches aiming to replicate what would be found at the front.

The galleries are low in height and comparatively shallow, no more than 25 feet beneath the surface, reminiscent of those dug at the front early in the war in 1915. They do not appear to be the work of professional miners and were probably dug either by an Engineer Field Company or Infantry Pioneers. It is probable they were being developed into dugouts.

The tunnelled galleries were cut with a flat-headed pick or mattock and feature an unconventional form of timbering with just one vertical prop and the other end of the sill slotted into the chalk wall. Soot from a candle can be seen on the wall to the right. Four men of the 3/4th Battalion Wiltshire Regiment left their names on 13 October 1917. At least one of them, Oswald Thomas Gardiner Rhodes, served overseas and survived the war.

The site has been laser surveyed and compared to a 1917 trench map. What was found had clearly been developed beyond that shown in the map as successive units extended the trenches and tunnels. The artefacts bear witness both to training activity and the daily lives of soldiers spending several days at a time in the trenches. These include a British Lee Enfield rifle, commonly used for training and possibly damaged by shellfire, and tins which contained *Craven A* cigarettes and *Coral Flake* tobacco. The trenches were believed to have been filled in soon after the First World War and contained much detritus including cigarette and ration tins.

Research into Salisbury Plain during 1914–18 and discoveries such as this are changing the understanding of its importance in preparing soldiers for battle. By 1916, training was highly realistic, incorporating the latest tactics.

In particular, Major General Monash's 3rd Australian Division trained here from August to November 1916 making use of the opportunity for highly realistic training in conjunction with artillery and aircraft. The proximity of gunnery and aviation schools facilitated co-operation with the infantry to develop the 'all-arms' battle which became a highly effective feature of British fighting methods in 1918.

SOURCE: Simon Jones, Historian

South Creake ROC Post site in Norfolk finds new use

Bunkers which were used in the Second World War to spot approaching enemy aircraft will be a lot more welcoming to visitors in a proposed new role. Plans are with West Norfolk Council for a Royal Observer Corps monitoring post and subterranean bunker at South Creake to become a site for five innovative and eco-friendly holiday lets.

The scheme is seen as a way of protecting historic assets and at the same time creating a business. The post and bunker, sited between Bloodgate Hill and London Lane, are Grade II listed military heritage assets but currently inaccessible to the public. They are on high land with panoramic views to the north towards the coastline which is why they were such an ideal location to detect enemy aircraft in WWII.

The observation post was equipped with rudimentary sighting and plotting equipment and, most importantly, a telephone. In 1955 the ROC was given responsibility to warn of air attacks and to measure radioactivity levels due to the potential threat of a nuclear attack during the Cold War.

The above-ground monitoring posts offered little protection from radioactivity so a network of underground posts were constructed alongside them. Both have been illicitly accessed and graffitied and in their current state, both heritage assets are considered to be at risk. People could walk right past the site and not realise its historical significance. A statement in the application claims that

South Creake ROC post in 1999, at this time it was used as a seismic monitoring post. Photo Nick Catford

the holiday lets proposal will restore and incorporate the history of the site, protect the assets and offer visitors a better understanding of their history.

The scheme would construct five contemporary units raised above the ground on slender concrete legs to give occupants views north to the sea. Each unit will have a large glazed sliding door to make the most of the location and will be accessed by a metal stairway to mimic the original posts' access ladders. The site is intended to be self-sufficient in generating its own power and treating its own waste water on site. After stand down of the ROC in 1991, South Creake was one of six ROC bunkers retained as a seismic monitoring post.

SOURCE: *Lynn News,* 4 August 2022

NEWS – MINES AND MINING

Welsh gold mine for sale

A 480-acre forest estate is up for sale for £3.75 million and comes with its own river, ponds and a 19th-century shaft where gold was excavated. The countryside property, which is owned by best-selling wine expert and author Hugh Johnson, includes the former mine.

Mr Johnson is now selling Cae Gwian Forestry Estate, North Wales, which has been owned by his family for more than thirty years, and wants at least £3.75 million for the whole estate. Mr Johnson, who writes the annual Pocket Wine Book, said, "In the centre are the remains of a 19th-century goldmine – though it produced more copper than gold."

Its water supply, the Afon Dwynant, flows through the heart of the property, while the leat that turned the waterwheel of the mine supplies water to four old stone cottages scattered among the trees. The old mine office building with its splendid fireplace has been rebuilt as a shelter and picnic place.

Located on the Afon Mawddach estuary in Snowdonia National Park, the property has won Royal Welsh awards for its commercial management. The old goldmine was opened in the 19th century during the Welsh gold rush

Entrance to the old mine

when prospectors flocked to the area. Before the mine closed down in 1900 the shafts were dug by miners prior to installing and building new railways and a water-powered mill.

But in the last 60 years the forest has been used to produce timber and trees with some of the land classed as ancient woodland. Cae Gwian is an unusual forest of exceptional beauty and charm, stretching over two hill ranges, one overlooking the estuary of the River Mawddach, the higher one overlooking the first, a green valley grazed by sheep between, and beyond the rocky massif of Cader Idris to the south and the Irish Sea to the west. Stone roads give access to the various parts of the forest and provide magnificent viewpoints; footpaths (two of them public) follow the stream and lead to other viewpoints

SOURCE: *MailOnline,* 23 September 2022

King Charles takes Poldark mine to court

A Cornish tin mine where the popular BBC series *Poldark* was filmed has been forced to close after the owner refused to pay rent to Prince Charles. The heir to the throne (now King Charles III) took court action against the owner of Wheal Roots Tin Mine – known more recently as the Poldark Mine – over unpaid rent on the lease of the underground passages that make up much of the tourist attraction.

The Duchy of Cornwall – the body which handles Charles' land and property portfolio – is the legally registered owner of the mineral rights at the mine, as it is at other sites around the county, according to legislation dating back to 1844. David Edwards, 71, argues that the fact the site is no longer used for extracting resources beneath the surface, but is instead an open-air museum, means the Duchy should not have ownership.

However, he admits he signed a lease agreement when he took over the site, which lawyers for the Duchy are using to enforce the payment of rent. His refusal to do so resulted in two County Court Judgments being filed against him, meaning he faces debts of more than £40,000 including solicitors bills.

The mine, which operates within a World Heritage Site, and has been a popular visiting spot due to its connections

with the BBC drama, has been closed for three years amid the wrangling. Mr Edwards said recently, "I operate on a not-for-profit basis and I don't draw a salary. We're in the process of trying to become a charity. I've put £250,000 into repairs and to keep the place going because it's a very important part of Cornwall's heritage. The feudal greedy grip that the Duchy has on Cornwall is beyond reason. There's something not very pleasant about the way they operate and I don't like it. I feel like I've been shafted."

The Prince of Wales made some £22 million last year, generated by the Duchy's vast portfolio of land, buildings and financial investments. Some of the private estate's income is generated through the deaths of Cornish people who pass away with no will or living relatives. All unclaimed property automatically passes to the Duchy under centuries-old powers known as *bona vacantia* – the legal term for ownerless land.

A Duchy of Cornwall spokesperson said, "Mr Edwards was not receptive to several attempts by the Duchy to engage with him to resolve this matter, so the Duchy was left with no option but to go to court. As the court has recognised on more than one occasion, this dispute relates to Mr Edwards' non-payment of rent. In both cases, the court ruled in the Duchy's favour."

Poldark Mine

The Poldark series is based on the novels of Winston Graham and ran initially from 1975 to 1977, before returning from 2015 to 2019. The Poldark mine site was such a significant tourist attraction, it was described as "one of the two most atmospheric mine tours in Europe, the other being the Wieliczka salt mine in Poland" by a former boss of English Heritage.

SOURCE *MailOnline* 23 September 2022

Explorers discover Australia's deepest known cave

Cave explorers have traversed what's now the deepest known cave in Australia. On 30 July a group of explorers discovered a 401-meter-deep cave, which they named Delta Variant, in Tasmania's Niggly/Growling Swallet cave system within the Junee-Florentine karst area. Its depth just beat out its predecessor, the Niggly Cave, by about 4 meters.

With a descent that lasted 14 hours and took many months to prepare for, Delta Variant is causing a stir among

Members of the group who discovered the cave

explorer communities. But it holds a different kind of fascination for researchers who study the interaction between groundwater and rocks (including in the context of caves). This helps us learn about natural processes and how Earth's climate has changed over millions of years.

SOURCE: *Science Alert,* 3 August 2022

***Thirteen Lives* now on Prime Video**

The Hollywood version of the Tham Luang cave rescues in Thailand directed and produced by Ron Howard was released in selected cinemas on 29 July. It also began streaming on Prime Video on 5 August. The film stars Viggo Mortensen and Colin Farrell.

SOURCE: *Below*, Journal of the Shropshire Caving and Mining Club, Autumn 2022

Cave woman one million years older than thought

Fossils of the *Australopithecus africanus* species that were discovered in the Sterkfontein caves near Johannesburg had been thought to be less than 2.6 million years old. Modem testing methods now suggest this group of early humans roamed the earth between 3.4 and 3.7 million years ago. The caves have yielded more early human remains than anywhere else in the world – including the near complete skull discovered in 1947 belonging to an early cave woman nicknamed Mrs Ples.

According to the Smithsonian Museum, the species which walked on two feet were much shorter than modem-day humans. Males averaged 4ft 6in in height and females averaged 3ft 9in. New radioactive dating techniques that involved testing sediment around the fossils for levels of a rare isotope created when the rocks were exposed to cosmic rays suggest the fossils are actually one million years older than thought. Previously the *Australopithecus africanus* hominids were considered to be too young to have evolved into *homo genus*, our ancestors, who were already roaming the earth around 2.2 million years ago.

The updated timeline means that the species existed on Earth at the same time as the ape known as Lucy, whose 3.2-million-year-old remains belonging to Africa's *Australopithecus afarensis* were long considered to be the species that gave rise to the earliest humans. This means the two species could have interacted and bred, scientists say. Complicating our picture of where humans came from and suggesting it may not have been such a simple evolutionary line.

SOURCE: *BBC News,* 29 June 2022

NEWS – MISCELLANEOUS

Lost public toilets found in Liverpool

Routine repairs at a Liverpool dock uncovered a long-forgotten public bathroom buried deep underground. The toilets discovered at the entrance to the former Brunswick Half Tide dock, near South Ferry Quay, are believed to be almost 200 years old, and would have been used by dock workers bringing in cargo from the many timber ships which used the dock during the 1800s.

Bill Froggat, a heritage advisor from the Canal and River Trust, said: "Earlier this year, we were working to level some uneven paving slabs around the area of the entrance to the former Brunswick Half Tide dock near South Ferry Quay. On lifting one of the slabs we found beneath some steps leading down, and at the bottom of the steps, a small room with four toilets."

Users would sit on the wall on the left above a drop into the river. The uncomfortable low arch above the seat was to discourage people from staying too long

The toilets are essentially a wall to sit on with a long drop behind into the river; the carved stone arches above each toilet presumably designed to make the toilet a little uncomfortable so to discourage the dock workers from being too long away from work. They date from about 1830. Brunswick Dock was built by Jesse Hartley between 1827 and 1832 specifically for the timber trade.

The toilets were found on the south side of the former dock entrance. A subsequent examination of the contemporary Ordnance Survey maps, carried out by the Trust, indicates there is probably a similar toilet on the north side.

Close to the toilets and at the former entrance to the half-tide dock there are two octagonal gate huts built in 1836, which would originally have housed winch machinery for opening the river gates into the dock, a coal stove and benches around the wall. Below, there allegedly lies a vaulted coal cellar – but this has yet to be uncovered. The toilets have now been resealed for safety purposes. Bill said: "If funding becomes available, we would like to reveal this piece of hidden history on a more permanent basis."

SOURCE: *Liverpool Echo,* 22 October 2022

UK High Court seizes Brompton Road station

Back in 2014 the Ministry of Defence (MoD) made a seemingly incredible statement on its website. In a publicity article it trumpeted the fact that it had just sold a disused London tube station to a Ukrainian billionaire for £53 million.

Without disclosing his name, the MoD said the cash generated from the sale of the property at 206 Brompton Road would be ploughed back into the defence budget. The sale appeared to almost go under the radar. Some newspapers carried it, but no one appeared to look at the land registry documents to see who the station had been sold to. In March this year it was revealed that the disused station had in fact been sold to Dmytro Firtash, a well-known Ukrainian-born businessman who heads the board of directors at DF Group, a company listed at Portman Square, west London.

The station was confiscated from Firtash by the UK High Court in 2019, apparently in a bid to help Russian banks recall huge loans; just five years after the Foreign Office sold it to him. It raises huge questions about why the station was sold to him in the first place and highlights how closely the UK was willing to aid Russian interests as recently as 2019.

WWII gun operations room built into the lift shaft at Brompton Road station. The lift landing doorways are straight ahead. Photo Nick Catford

Firtash has been extremely influential in Russian politics since reportedly being the middleman between Vladimir Putin, Russian natural gas giant Gazprom and other key Russian and Ukrainian institutions. He made billions selling Russian gas to Ukraine at inflated prices.

He is on the list of the richest Ukrainians, but in June 2021 the National Security and Defence Council of Ukraine imposed sanctions against Firtash, alleging his titanium business aided the "military-industrial complex" of the Russian Federation. The suggestion was that his titanium was being used to help Russia's military.

Firtash bought the tube station building in 2014 and the MoD said it would be used for a residential purpose. Since then though, no plans have ever been submitted to Kensington and Chelsea Council to convert it. He claimed earlier this year his aim was to turn the building into a

"Ukraine House", a club for advancing Anglo-Ukrainian connections. "I was told this is how things operate in Britain," he said.

It just so happened the station was also next door to the London mansion he had also purchased in 2012. It doesn't seem as if the building was ever used for this purpose, but in 2011, Firtash was welcomed to Cambridge's Guild of Benefactors by the Duke of Edinburgh and thanked for creating "a vibrant home for the study of Ukraine for many generations to come". It seems at least that plans for a Ukraine House were in the works. This only happened though after he had donated some £6 million to Cambridge University – something that caused huge controversy.

The only planning application that appears to have been submitted at the property in the years Firtash owned it is one dated August 2018, for the installation of communications systems. This involves removing six existing antennas and replacing them with six new antennas, 15 RHR antennae and one GPS module. The application was submitted by Mono Consultants Ltd, based in Bletchley, on behalf of Telefonica UK Ltd. It appears in line with the usual installation of broadband and telephone coverage that is done under current UK legislation.

The application says it is simply to "upgrade an existing base station" that is present on the site. The application though seems to have stalled and is yet to be decided upon according to Kensington and Chelsea Council's planning website.

But before anything else could happen, the building – and Firtash's five-storey London mansion next door – was seized by the High Court of Justice. According to the *Kyiv Post*, this was because Russia's VTB Bank was seeking to get a return on loans in the amount of 2.5 billion Russian rubles. So Firtash had borrowed massive sums of money from Russia and Russia wanted it back. How different the court's decision may have been if it had come after Russia's invasion of Ukraine.

At Companies House, the tube station address still has a company listed under it owned by Firtash. It's called the Firtash Foundation. But no accounts have been registered for the company since 2016 and it is in the process of being struck off by Companies House. All the directors appear to have resigned in 2013–14. The nature of its business is listed as "Activities of extraterritorial organisations and bodies". Firtash himself is not listed as working for the company but Lada Firtash, his second wife, is.

It seems Firtash's plans for the station stalled because of a series of international scandals he was caught up in. Firtash was embroiled in the Ukraine scandal which plagued Donald Trump's presidency. He fought against an extradition order to the US for alleged bribery. This was thought to be part of a campaign to secure a mining project in India.

Firtash was indicted by the United States in June 2013, accused of conspiring with five other people in 2006–10 to pay at least $18.5 million in bribes to Indian officials to acquire a titanium mine in India. He was arrested in Vienna on orders of the FBI and has remained there ever since under bail conditions.

SOURCE: *My London* , 21 September 2022

Nuclear waste burial site in Finland

Four hundred and thirty-seven metres underground on the southwest coast of Finland, a team of geologists are advising on where to blow holes into two-billion-year-old granite. This is no ordinary science project: buried here in the city's bedrock is Onkalo, a network of tunnels destined to become the world's first permanent repository for radioactive waste.

By the time construction is complete in 2120, this toxic graveyard will span 50km of tunnels – some as wide as suburban streets and taller than a double-decker bus. A total of 3,250 copper canisters containing around 6,500 tonnes of spent uranium will be buried here and – hopefully – left undisturbed until the radiation has diminished in 100,000 years.

The site will be "ice-age proof", according to Johanna Hansen, the project research and development coordinator. "One thousand years into the future, there will be no sign we were ever here. In 10,000 years, we don't even know what language we will be speaking. So this must be a secure and final repository," she says.

Nuclear power offers a clean and plentiful source of energy, but it comes with a toxic legacy. High-level waste from spent fuel contains radioactivity that remains dangerous to humans for millennia.

Inside Finland's first nuclear waste graveyard which will be 'ice-age proof' and span 50km worth of tunnels, some as wide as streets and taller than a double-decker bus

It's a growing problem: around 263,000 tonnes of used nuclear fuel is currently sitting in interim storage facilities, according to International Atomic Energy Agency estimates. A common solution is to fill swimming-pool sized areas with the waste and cover it. Some countries, including France, recycle uranium to make new fuel and by-products. Both are expensive. The vast majority of UK waste is held in storage facilities at near-ground level in Cumbria – the management of which contributes to an annual nuclear decommissioning cost of £3bn per year.

With Onkalo, Finland is choosing to bury the problem – literally. And consultation requests from Spain, Germany and Canada, to name a few, suggest others will follow. "It's possible that countries with smaller amounts of waste will form joint repositories," says Ms Hansen. "But everyone will have to do something eventually. Sure, you can recycle it, but in the end it is still waste, just in a different form."

Nuclear power currently makes up around 26 percent of Finland's energy. The opening of a third nuclear reactor at Olkiluoto Nuclear Power Plant will bring energy production up to 1,600 megawatts, powering a third of Finland's electricity, in accordance with ambitious climate targets. Finland has committed to becoming carbon neutral by 2035, and Helsinki has pledged to beat that target by another five years – closing down its only remaining coal factory by 2024, half a decade ahead of schedule. Expanding nuclear outputs is central to this transition.

But the Russian energy crisis has thrown an additional level of urgency into the mix. Until March this year, 30 percent of Finnish energy was imported from Russia. Electricity supplies were cut off on 14 May and natural gas imports stopped a week later. This has left Finland with a 20 percent energy gap – which is being filled, in part, by importing coal all the way from Australia and South Africa.

It's a disappointing but temporary fix – one that is necessary given the unreliability of wind and solar power, explains Jukka Leskelä, managing director for Finnish Energy. "Finland is effectively an island – its Nordic borders are Arctic and the border it shares with Russia is now strictly shut," he says. "To say that we need to find new ways of becoming self-sufficient is an understatement. Nuclear is a realistic solution."

Helen Oy, Helsinki's biggest energy provider, says the city has more than 99.99 percent energy security, but at the same time, citizens have been warned about potential blackouts this winter. For Finns, who are largely in favour of nuclear expansion (60 percent compared to 38 percent in the UK), the newly online production facilities at Olkiluoto cannot come soon enough. The site's three reactors are already powering 36 percent of Helsinki city; when fully operational the new reactor will be the most powerful in Europe.

When it comes to getting the public on side, transparency on the reasons for – and against – use of nuclear power is key, says Pasi Tuohimaa, director of communications at the Olkiluoto site. "You have to be brave enough to tell people the bad things – the things that don't work so well – as well as those that do," he says.

"Nuclear strategies have never failed because of safety issues, but always because of bad communications. It's easy to take the subject to the political mill, and people are easily led by emotions in politics. But now in the US, they're asking the same questions as we were in Finland 30 years ago," he concludes.

SOURCE: *I News,* 16 October 2022

Athens metro extension opens

Operation has begun on the second phase of the €730m Athens Metro Line 3 extension, with trains now running to Maniatika, Piraeus and Municipal Theatre stations. The full 7.55km extension built by the Avax-Ghella-Alstom consortium includes six stations, with the first phase to Agia Varvara, Korydallos, and Nikaia opening in July 2020. The opening of the second phase is expected to increase passenger numbers on the metro network by 132,000 a day, removing 23,000 private road journeys and reducing CO2 by 120 tonnes.

The line is reducing travel times between the Port of Piraeus and Venizelos International Airport from 1h 10min to 55 minutes. Services will operate at four-minute intervals on the Municipal Theatre – Dukissis Plakentias section during peak hours, reduced to every nine minutes between 22.00 and 00.20hrs.

Line 3 now has 27 stations. Piraeus station required special construction methods to prevent sea water entering the site and to ensure the structural integrity of adjacent historic buildings. The station also serves as an interchange between lines 1 and 3, the port, the suburban railway and light rail services, with an underground passage providing access to the port under Akti Kalimassioti Avenue.

The historic Municipal Theatre Square was restored during the construction of Municipal Theatre station, while a new square was created above Maniatika station.

The southbound platform of Municipal Theatre station on the first day of operation. Photo Argybz, reproduced from Wikipedia under creative commons licence

Alstom's share of the project included design, supply and installation of the traction power systems, including third rail electrification, the medium-voltage supply and the distribution of low voltage. As part of the project, a software upgrade has been undertaken at the 76 equipment rooms already in operation on lines 2 and 3.

Alstom installed its Iconis supervisory control and data acquisition (Scada) solution for metro power supply systems.

Alongside the opening of the new sections, Alstom is extending its Automatic Train Supervision (ATS) system to cover the whole of lines 2 and 3, which will improve safety and operational efficiency.

"This is undoubtedly a landmark both for us as a consortium and the city of Piraeus," says Avax group managing director, Konstantinos Mitzalis. "Despite the challenging ground conditions, the restrictions of the pandemic, the delayed delivery and increased cost of materials and lately the invasion of Ukraine, we were determined to deliver the three new stations on time as promised back in 2020, when we delivered the first three stations."

Athens Metro also awarded the Avax-Ghella-Alstom consortium a $US 1.8bn contract for the construction of the first phase of the 38.2km Line 4 in November 2020. The contract covers the construction of the 12.8km Section A, which runs from Alsos Veikou via the city centre to Goudi, with 15 stations including interchanges with lines 2 and 3.

SOURCE: *Independent Railway Journal,* 12 October 2022

New bar opens beneath the Royal Exchange, London

Both whiskey and The Royal Exchange have been around for a while. An early reference to the Scottish spirit traces it back to around 1494 whereas the somewhat-babyish-in-comparison commercial building was opened by Queen Elizabeth I in 1571. And, after 450 years of beautiful coexistence in separate harmony, the pair have finally teamed up to deliver the Scotch-filled-speakeasy that you never knew you needed.

The Libertine is the brand new venue unpacking their highball glasses in the vaults under The Royal Exchange. Beneath the floors of the building, London's revellers will be treated to multiple drinking and dining spaces, private dining rooms including a special whiskey vault for tasting experiences and much more.

The Libertine is open now at the vaults under The Royal Exchange, EC3V 3LL (nearest station is Bank).

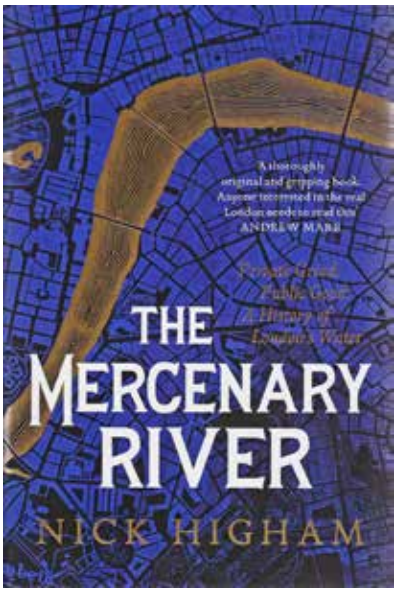
SOURCE: *Secret London,* 18 November 2022

PUBLICATIONS AND BOOK REVIEWS

The Mercenary River

HIGHAM, Nick, 2022, Headline Publishing Group, 470pp, £22

ISBN: 9781-47228-383-2



Book Review by Martin Dixon

Accounts of the development of London's sewer network are relatively common but this is the first volume that I've come across to describe in detail how fresh water was delivered to the residents of the nation's capital. Much of the infrastructure – especially on the delivery side – is underground, hence the interest to *Subterranea* readers.

The book is authored by Nick Higham, who some may remember as the BBC's arts correspondent. The book was researched at the London Metropolitan Archives in Clerkenwell, demonstrating what a rich seam of subterranean history lives within its walls. The title reflects the fact that, from an early date, the supply of water was seen as a profit-making enterprise rather than as a public service. The original quotation is dated 1776 and in part reads:

'... our mercenary stream. No grandeur boasting, here obscurely glides.... (through)... pipes innumerable, to peopled streets transmit the purchas'd wave.'

The story is told in chronological order, starting with conduits built in the thirteenth century. Much detail follows on Myddelton's 'New River', dating from 1613, whose channels still supply around ten percent of London's water needs. The following chapters describe the development of other water supply companies and of the engineering, political, scientific and financial challenges faced.

The debate between public and private ownership started early and continues today. It was only in 1904 that the water companies entered public ownership, a move reversed by Margaret Thatcher in 1989.

Although not the major focus, the story of London's waste water disposal (to some extent an unintended

consequence of an enhanced water supply) is also told. The writer's style is very readable and brings some surprises; for example the Victorian water company (The Southwark & Vauxhall Waterworks) that cut off 2,000 subscribers in Richmond without notice after a dispute with the local authority.

The volume usefully makes use of chapter sub-headings and is well proofread. There are occasional footnotes but most references are delegated to 24 pages at the end of the book; there is an extensive bibliography. Around twenty illustrations are included in a single central section, most but not all showing surface features. A map at the beginning of the book shows the dozen or so water companies in 1884 and their respective extraction points

Numerous contemporary quotes enliven the text, such as Ben Jonson's description of a boat trip up the revolting River Fleet in 1612:

'Row close then slaves. Alas, they will beshite us. No matter, stinkards, row. What croaking sound is this we heare? Of frogs? No, guts wind-bound, over your heads. Well row....'

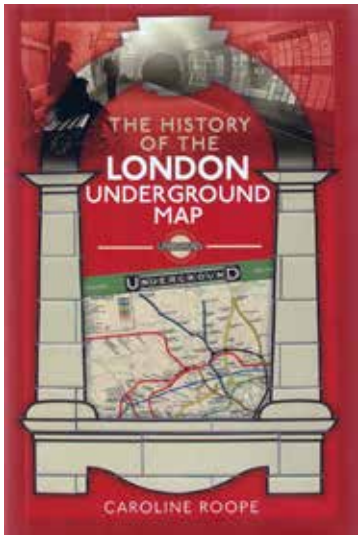
I would have appreciated a gazetteer of what remains to be seen today and visited, perhaps along with a map showing London's culverted and otherwise lost rivers. For my own preferences there is a slight over-emphasis on the legal framework of the early water companies. Some of the sentences seem to be overlong, even when broken by semicolons; as early as page three, one sentence takes up almost an entire paragraph and lasts for a breathtaking 92 words.

Overall though, Nick Higham has done a great job in telling the long and fascinating story of London's water supply. Leak management, investment versus profit, and ownership of key infrastructure remain as relevant today as in the early days as a glance at any news report this past summer will testify.

The History of the London Underground Map

ROOPE, Caroline, 2022, Pen and Sword Transport, 224pp, £20

ISBN: 9781-39900-681-1



Book Review by Martin Dixon

The map that guides residents and visitors alike round London's underground network is world famous. It has been an influence on rapid transport maps across the globe and owes much – but not all – to the visionary draughtsman Henry ('Harry') Beck (1902–1974). This book by freelance writer Caroline Roope traces the story of this map (which should properly be termed a diagram as it bears only a partial relationship to surface features in both direction and scale).

In order to tell the story, the book delves deep back into the story of London Underground from the first cut-and-cover lines of 1861 through to today's TfL Journey Planner. For my money, there is way too much background detail that duplicates other published histories of the network. For example, the prosecution and suicide of financier Whitaker Wright (known to Sub Brit members as the constructor of Witley Park's underwater ballroom) is not of any direct relevance to the story being told. Perhaps to some readers with a more superficial interest, having a fuller history in the same volume might be a plus

The book explains that two major prerequisites were needed in order for Beck's diagram to emerge. The first was a network under sole ownership and control, or at least operated by companies with a cooperative approach to signage and direction finding. In early years maps often omitted the lines of rivals and full unification only came with the establishment of the London Passenger Transport Board in 1933. Even then, the Waterloo and City line was excluded, finally joining the fold in 1994.

The second prerequisite was a recognition that to provide the clearest network diagram, true geography had to be distorted. With few exceptions (the central section of the Central Line being one) underground lines bend and loop; slavishly following these surface features in a transport map leads to a complex and muddled image.

In addition, the number and proximity of stations in central London far exceeds those in the suburbs. An expanded scale for central London was first introduced by Fred Stingemore in 1925; his map also excluded surface features and showed interchange stations with an open circle.

Stingemore himself encouraged Beck to produce his seminal work, which finally appears in chapter 16 (of 26). The most radical step that Beck took was to limit the representation of the route network to horizontal, vertical and diagonal straight lines inspired, it is said, by an electrical circuit diagram.

Sadly, Beck fell out of favour and when in 1960 draughtsman Harold F Hutchison produced an updated derivative of his work, Beck reacted furiously and never worked for the organisation again. The book's historical journey concludes with the work of some recent (mostly unofficial) cartographers in making further improvements to the network diagram.

The book has short chapters and is well supported by a bibliography, references and an index. The index however is not as comprehensive as I would wish and in particular does not include the illustrations in its entries.

There are some curious perspectives in the text – such as the assertion that the work of the 'navvies' who worked on early lines has been forgotten in the 21st century. I'd also like to have seen their current name in brackets for those stations that are referred to by an earlier name.

My strongest criticism is of the book's illustrations. They appear in a single centre-section and are too small, too few and too jumbled. The book itself is around 16 x 24 cm and yet often two maps of the complete network are stacked one above the other in this space. As a result, although the design principles can be appreciated, the detail of the maps is often unintelligible. MacDonald Gill's magical pictorial map of 1914 is rendered completely unreadable which is a sad loss.

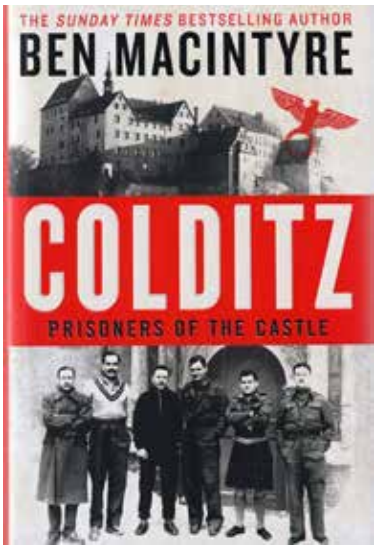
Pivotal maps (diagrams) in the story which are usually well described in the text are sadly missing from those illustrated. Bizarrely, both Stingemore's seminal work which preceded Beck's, and Hutchison's controversial work which followed, are completely absent. Of course, these maps can always be viewed on the internet but this somewhat defeats the purpose of the book.

Lastly, the order of the maps that are illustrated bears no resemblance to a historic timeline. The first three maps featured date from 1897, 1908 and 1883 and Beck's own work of 1933 appears between works of 2011 and 1914. This makes it very difficult to follow the thread of design development, especially as the unnumbered images are not referenced from the text.

Overall, the book is a disappointment. The text has some tasty morsels but the illustrations in particular were a real let-down. Tastes and appetites vary, but personally I felt I'd been offered a first-rate menu that the chef failed to deliver.

Colditz: Prisoners of the Castle

MACINTYRE, Ben, 2022, Viking, 369pp, £25, ISBN: 9780-24140-852-0



Book Review by Martin Dixon

Colditz prison camp has been the subject of a number of previous WWII histories from both prisoners and historians – and in at least one instance (Reinhold Eggers), a German security officer. This latest volume draws a lot on previous publications and tells the complete story of Colditz including an 'aftermath' of what happened to some key players postwar.

The underground interest comes from the many escape tunnels that were constructed by the occupants, up to twenty of which were discovered during construction, while a few reached their full length. In the early days, inmates of different nationalities (principally British, French and Polish) had a distrust of others and tunnellers almost ran into each other. Later there was greater co-operation between prisoners and in the final days the British became the sole residents of the castle.

Many of the tunnels had evocative names such as Crown Deep, Toilet Tunnel and *Le Metro*. Subterranean space was also used to store clandestine material such as escape kits, food from Red Cross parcels and even radios. A fascinating chapter describes how concealed maps, compasses, currency and other escape aids were designed by MI19 and then smuggled into the camp.

One particular crafty scheme involved two prisoners (Jack Best and Mike Harvey) 'disappearing' from roll call which led the Germans to believe they had successfully escaped. In fact, they remained hidden away beneath the chapel pulpit for months, waiting for a better opportunity to escape and occasionally filling in for other escapees to delay the raising of the alarm.

The book is full of examples of how behaviour in the camp was heavily influenced by the memories of public schools that many of the British officers had attended. Most of the guards were given nicknames, ranging from the blunt Dopey, Pieface and Bastard to the more obscure Cheese and Auntie. Many of the guards were mercilessly baited including by such bizarre behaviour as walking imaginary dogs and knitting on parade.

An extension of this public school influence was that officers had their own batmen or orderly. These other ranks were not involved in escape attempts and lived in separate quarters. One of the cruellest behaviours in the book came not from the Germans but from a British officer. Douglas Bader's batman Alex Ross was selected to take part in a prisoner swap with the Allies in 1943. Bader (who despite his flying skills had a thoroughly arrogant and unpleasant character) expressly forbade it and Ross spent the rest of the war in captivity, carrying the legless Bader up and down stairs for his daily bath.

Life in Colditz mirrored social mores across wider society at the time. As well as the officer and orderly groupings, there was an upper-class elite known as the *prominente.* These, who included Winston Churchill's nephew, were largely incarcerated within Colditz not as serial escapers

but because the Germans saw them as potentially useful later in the war.

Minor characters (such as Birendranath Mazumdar, the sole Indian prisoner, and Lee Carson, a female war reporter) are described at some length although they are largely tangential to the book's main narrative. Eighty years on, it felt to me that these inclusions – and quite a treatise on sexuality within the camp – are largely there to generate review headlines and increase the book's sales.

Overall the book is very readable but in truth is largely compiled from already published works. Many prisoners and their exploits are described in detail but in places there is a slight feel of reading a 'Who's who'. Macintyre seems to have a downer on Major Pat Reid, MC, whose early 1952 account *The Colditz Story* was undoubtedly gung-ho but who did have the advantage of having actually both lived in and escaped from Colditz.

The text is supported by excellent maps and plans, often missing in similar books. The selection of 85 images is also especially valuable, with many photos of the occupants and scenes of the castle including some images of tunnels and their portals.

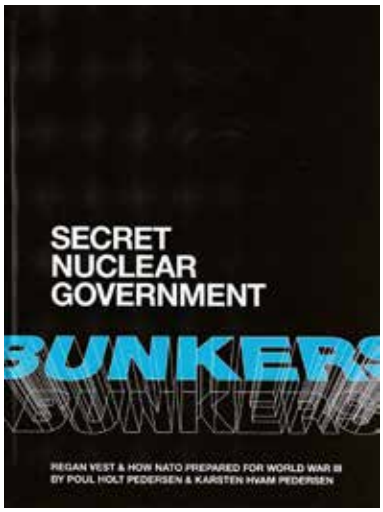
The index is extensive – arguably occasionally too complete, including as it does a reference to the cardboard cut-outs of Douglas Bader and Airey Neave that now adorn the site to be seen by tourists.

Overall to be recommended with the rider that, like the tunnels themselves, some of the topics are explored in greater depths than others which never reach their full potential.

Regan Vest – Secret Nuclear Government Bunkers & how NATO prepared for World War III

PEDERSEN, Poul and PEDERSEN, Karsten, 2022, REGAN VEST since 1994, 276pp, DKr298

ISBN: 9788-79739-700-8



Book Review by Martin Dixon

This volume is a labour of love which details in great detail the background, construction and operation of Denmark's most secret bunker, codenamed REGAN VEST – an abbreviated form of *Regeringsanlæg Vest* or Government Facility West. Constructed between 1963 and 1968, it would have housed the Danish Government and Royal Family in the event of World War III erupting. Construction was by the same company who built the coastal artillery complex at Stevns Fort, visited by Sub Brit in May 2017 (described in *Subterranea* 45).

In the best traditions of misinformation it was sometimes known as the *Gravlev* bunker even though that village is not the nearest to the facility. In summary, it is the Danish equivalent of the UK's Cold War BURLINGTON facility beneath Corsham but it is in a hugely better state of preservation.

Brothers Poul Holt and Karsten Hyam Pedersen first heard of the bunker's existence in 1994 and since then have made extensive studies of the site and its history, especially after it was officially revealed in 2012. The bunker is tunnelled out of the bedrock and lies up to 60 metres beneath the surface. The protected structure takes the unusual form of two double-level rings linked to each other and to the entrance and emergency exits by long passages; in plan it looks a little like a pair of John Lennon's glasses! The only other annular shaped shelter I recall was the WWII Paris Metro command centre at Monceau Metro Station which Sub Brit visited in 2008.

Poul Holt has kindly written an article on the site which appears elsewhere within this edition of *Subterranea*. If that serves to whet your appetite then this more comprehensive work is a must. The core of the volume describes REGAN VEST itself but earlier chapters detail the historical context, the nature of Denmark's civil protection programme and earlier protected facilities in the country. The end of the book describes other protected sites in Denmark, including the still-active REGAN ØST (east) and the NATO Headquarters Bunker 7. It concludes with a summary of similar structures in other NATO countries.

The book is well illustrated throughout and the text is broken up with fascinating panels which tell snippets of the story from those who were involved in its construction and operation; for unlike Corsham, there were many rehearsals which included a visit from the Danish Royal Family.

Some of the smaller details are fascinating – for example the Communications room had a wall-mounted hammer in order to be able to destroy the equipment to prevent false messages being sent if the facility was overrun. I also found out that Denmark had its own 'Strategic Reserve' of steam locomotives until 1969.

There is a comprehensive list of reference notes and a Cold War timeline. There is no index but this is offset to some extent by a detailed contents list which gives a breakdown of each chapter. The paper is a little on the thin side to do the contents justice. In effect the book uses Denmark as a case study for the whole of NATO and the title is a little misleading as only twenty pages are dedicated to facilities outside Denmark. The book

is overall very well proofread although a few terms could have been better translated (for example *hall* is sometimes used instead of corridor and *pincher* is used instead of pliers).

The bunker is now protected under Danish Law which is great news. Even better news is that the complex is planned to open as a Cold War museum in early 2023. Sub Brit plans to arrange a weekend in Jutland next spring, with this site as the key attraction. This book is thoroughly recommended both to those who can attend and those whose appreciation will remain more distant.

In the words of former NATO Commander Lieutenant General Hillingsøe who wrote in the preface:

"In my mind, there is no doubt that REGAN VEST will go down in history as a symbol of how fragile civilisation is during a modern war. At the same time, we can be pleased with the fact that we have never needed the facilities and hopefully never will."

NEWS – TUNNELS AND TUNNELLING

Belmarsh prison tunnel 'too cold' to be used by inmates

Prisoners are being driven 200 yards from a high-security jail to court because they refuse to use a secure tunnel linking the two, it has been claimed. The Ministry of Justice has spent millions of pounds of taxpayers' money over the past six years on prisoner escort vans to complete the two-minute journey.

Inmates at HMP Belmarsh in southeast London are understood to have complained the tunnel is too cold in winter. Others have objected to having to carry their possessions on the short walk to Woolwich Crown Court. The underground route was constructed to transport high-security prisoners between the prison and the court complex next door.

Details obtained from the MoJ under Freedom of Information laws show transport company Serco has been paid for 20,499 secure van journeys between the court and the prison since the start of 2016. While the MoJ refused to disclose the fees paid on commercial grounds, Serco receives a fixed price for each van journey, it is understood. Experts estimate each journey is likely to cost more than £100, meaning the cost over the past six and a-half years is likely to be well over £2 million.

Loading and unloading prisoners on to secure vans also requires a series of lengthy checks, taking hours of staff time. The main gate at Belmarsh is just 180 yards from the secure entrance of the court. The tunnel, which takes a direct route, is considerably shorter.

Most high-security terrorism trials take place at Woolwich, which opened in 1993, because it is considered more secure than the Old Bailey, built in 1902. One senior court source said inmates had complained about the temperature in the tunnel, and the MoJ statistics reveal that van journeys are tthirty percent higher in winter months than they are in the summer.

Figures peaked in 2017, when 4,325 van journeys took place. An MoJ spokesman said: 'These claims are entirely false and the tunnel is in constant use.' Some journeys were taken by newly sentenced prisoners who had to travel by van because they were carrying their possessions, it is understood. The MoJ was unable to provide a breakdown.

SOURCE: *MailOnline,* 8 October 2022

National Trust members to vote on new Stonehenge tunnel

National Trust members are set to vote on whether they support plans for a new tunnel near Stonehenge. Former Transport Secretary Grant Shapps approved the proposed £1.7bn two-mile tunnel for the A303 in 2020.

The Wiltshire road is well-used by drivers travelling through the west of England and the project hopes to ease traffic issues. Campaigners have called the planned tunnel, which would be on National Trust land, an "international scandal".

Dr Kate Felden is a member of the National Trust and also the Stonehenge Alliance, which opposes the scheme. She said: "The NT is not obliged to take any notice of the final vote by its members at an annual general meeting. Although, I think it probably would take some notice and maybe would reconsider its approach to the scheme." However, organisations such as the Stonehenge Traffic Action Group are campaigning for the tunnel as a solution to traffic issues in nearby villages like Shrewton.

Back in 2020, the Planning Inspectorate had recommended Transport Secretary Grant Shapps withhold consent for the project, warning it would cause "permanent, irreversible harm" to the World Heritage site. But the Department for Transport wrote to Highways England stating: "The Secretary of State is satisfied that, on balance, the need case for the development together with the other benefits identified outweigh any harm."

SOURCE: *BBC News,* 5 November 2020

TFL tunnel-boring machine begins digging under London

Contractors have launched the first of six machines that will dig the tunnels for London's new High Speed 2 (HS2) railway. The tunnel-boring machine (TBM) – dubbed Sushila after local teacher Sushila Hirani – was activated near West Ruislip railway station in September.

It is one of two TBMs which will dig a five-mile twin-bore tunnel to Greenford over the next 22 months. The two 2,050 tonnes machines will begin excavating the high speed railway tunnels over the next two years, to create five miles of the 8.4 mile Northolt Tunnel for HS2 trains. Once they reach their destination they will be dismantled and lifted from the ground.

Another pair of machines will dig a tunnel from Old Oak Common to Greenford, and two more will connect Old Oak Common with HS2's London terminus, Euston. Each TBM will be operated non-stop except for bank holidays by fifteen people working in shifts. TBM Sushila, operated by civil engineering company Skanska Costain Strabag JV, is HS2's first machine to commence tunnelling to London.

An identical machine called Caroline, named after astronaut Caroline Herschel, will launch later this year. TBMs are traditionally given female names. Caroline will follow the same route as Sushila to create a twin-bored tunnel towards central London.

HS2 Ltd chief executive Mark Thurston said recently, "When you look at some of the broader policy challenges that the country has got and this or any government have got, I think HS2 is a big part of some of the solutions to those." James Richardson, managing director at Skanska Costain Strabag JV, echoed the sentiment, adding "We are starting one of the most complex parts of HS2, tunnelling from here at West Ruislip towards Euston beneath one of the busiest cities in the world. The huge team effort has enabled some of the most advanced TBMs ever built to be launched."

In total, builders will utilise ten TBMs on the HS2 project as they create 102km of tunnel between London and the West Midlands. A team of approximately forty people assembled the TBMs. Fifty-six companies are involved in getting the constructions site ready and launching the machines.

SOURCE: *MailOnline,* 6 October 2022

Work starts on new London river crossing

Work on a new twin-road tunnel beneath the River Thames in east London has begun. The Silvertown Tunnel will link the Royal Docks north of the river with the Greenwich Peninsula in the south. Transport for London (TfL) said the route would cut congestion and ease pressure on the Blackwall Tunnel, but opponents believe it will increase air pollution. The 0.9-mile tunnel is expected to open in 2025. Charges will be introduced for using both tunnels once the Silvertown Tunnel opens. The level of charges has not been determined.

TfL's head of the Silvertown Tunnel programme Helen Wright said: "The start of tunnelling is a huge step forward for this project and we are committed to working hard to ensure that it is delivered with minimal impact to Londoners. As well as reducing congestion and providing better cross-river bus opportunities, the new tunnel will also help deliver a wide range of local improvements, including dedicated walking and cycling infrastructure and new landscaping. We are working actively on these designs and we hope we can share these with local residents and stakeholders shortly, ahead of starting work on them within the next year."

The Stop the Silvertown Coalition campaign group said the tunnel "will substantially increase London's CO2 emissions at the worst possible time in the ongoing climate emergency."

Nearly 600,000 tonnes of material will be excavated during the project. This will be removed via barges on the Thames to minimise construction-related traffic on local roads. The material will be sent to a former landfill site in Essex as part of a restoration scheme.

SOURCE: *BBC News,* 7 September 2022

WWII Air-raid shelter found in South London

An early example of a WWII air-raid shelter has been uncovered during building site clearance works in Plumstead, in southeast London. The air-raid shelter was an unexpected discovery, as most are known about, and this one doesn't seem to have been a private shelter, so would have been known about by the local community at the time. That makes its subsequent disappearance from the war records even more mysterious.

The site of the discovery isn't being revealed due to client confidentiality. Charlotte Matthews, Head of Historic Buildings and landscapes at Pre-Construct Archaeology

(PCA), said: "The amount of concrete used in the bunker suggests that it was built early on in the war because later on in the war building materials were in scarce supply. The air-raid shelter reflects the fear people felt for their safety at the beginning of the war. Plumstead suffered particularly heavy bombardment due to its close proximity to the Woolwich Arsenal."

Photo Ian Mansfield

It wasn't safe to go inside so once the team had recorded the exterior with photos and a GPS plan, the contractors removed the roof of the bunker to clear the interior and record that for posterity. PCA says that the design of the bunker shows signs of learning from WWI bunkers dug during the Great War, and this one comes with two air shafts, and is likely to have had two entrances. Earlier bunkers tended to have just one, which meant people could have been trapped inside if rubble had blocked the entrance.

SOURCE: *Ian Visits* website, 11 November 2022

Glenfield railway tunnel opens to the public

A railway tunnel that was once the longest in the world opened to the public as part of a series of heritage days. Glenfield Railway Tunnel in Leicester was one mile long when it opened in 1832. It was used to transport coal into the city.

When the railway closed in the 1960s, the tunnel was bought by Leicester City Council for £5. It opened as part of a festival which ran from 9–22 September.

SOURCE: *BBC News,* 1 September 2022

Passengers evacuated from Channel Tunnel

Eurotunnel passengers had to be evacuated from a train after it broke down beneath the English Channel, with one passenger describing it as 'just like a disaster movie'. They were transferred to a cargo train but complained of being stuck in the sub-sea tunnel for nearly five hours, citing issues with the replacement transport.

The initial breakdown late on Tuesday 23 August affected the 3.50pm Eurotunnel Le Shuttle service from Calais to Folkestone and led to hundreds of passengers being ushered into a service tunnel. Videos on social media showed holidaymakers walking through the alternate tunnel alongside the 31-mile rail route between Britain and France, some with suitcases and dogs.

Meanwhile travellers in Calais were told to stay away from the terminal until 6am on Wednesday, with pictures showing gridlock at the shuttle terminal late into Tuesday evening. A spokesman for Eurotunnel Le Shuttle said: 'A train has broken down in the tunnel and we are in the process of transferring customers to a separate passenger shuttle via the service tunnel, to return to our Folkestone terminal.'

Michael Harrison, from Cranbrook, Kent, one of those on the evacuated train, said: 'We got on the 3.50pm crossing; approximately ten minutes in the lights went out and the train stopped. We were told they needed to investigate an issue with the wheels. It took approximately one and a half hours for them to investigate and obviously not find anything. They reset things and set off for another five minutes. It happened again at which time we waited a further couple of hours to decide they couldn't see a problem but had to evacuate the train to another train.

Passengers in the service tunnel

'After further waiting we left the train through the emergency link tunnel to the service tunnel. We then walked approximately ten minutes to a train in front of the stricken train. This was a bus carriage where we got transported to Folkestone. That train then stopped as it couldn't get traction, presumably as it was long and had no weight on it. There were gasps of incredulity when that was announced. We finally arrived in Folkestone six hours after boarding.'

Another passenger who was evacuated said that 'several people were freaking out about being down in the service tunnel; it's a bit of a weird place. We were stuck down

there for at least five hours. If I've got a gripe it's that they knew several hundred people were arriving at Folkestone who hadn't eaten for five, six or more hours and there was absolutely nothing for us here. Just huge queues for Burger King.'

SOURCE: *MailOnline,* 24 August 2022

Bank raid escape tunnel collapses trapping robber

A suspected robber had to be rescued after he was buried underground in a collapsed tunnel near the Vatican while his gang was trying to burrow 20ft into a bank. The man was freed after eight hours, with firefighters digging him out from under Via Innocenzo XI in Rome after the asphalt gave way.

It is believed that the man and his four accomplices were preparing to rob a bank vault nearby and dug the tunnel, which began near an empty shop, to reach it. According to Italian media, one of his four alleged accomplices, who managed to escape the collapsed tunnel, alerted emergency services-and firefighters then heard a voice from under the rubble.

Rescuers using mechanical diggers then dug a parallel hole to free the man during the long recovery operation while he cried out, 'Help, I beg you to get me out.' He was given liquid food and an oxygen cylinder to help him breathe, and eventually pulled out alive, while a large crowd cheered. The man was then taken to hospital, where he remains, with critical, but non life-threatening injuries.

A police spokesman said that two people from Naples and two from Rome had been arrested for resisting a public official and damage to public property. They added: 'We are still investigating. We do not exclude that they are thieves; it is one of the theories.'

SOURCE: *MailOnline* 12 August 2022

New tunnel being dug at Euston station

A large new tunnel is being dug underneath Euston station, by HS2, but not for HS2 – it's for London Underground. This is part of what's known in the trade as 'enabling works', the sort of work that's needed to prepare a brownfield site for what it is intended to become. That can be as simple as clearing rubble from a site, to major interventions such as moving sewers and utilities or decontaminating land.

At Euston, it requires the construction of a very large cube box above and below ground and a 90-meter long tunnel for the London Underground. To understand why, leap back to the 1900s, when the Northern line on the London Underground was still two separate competing railways, and in the 1900s, the two tube companies opened separate tube stations at Euston, on either side of the mainline station.

A deep-level tunnel linked the two tube lines, with a ticket office in the middle of the tunnel. They didn't last long though, and with an entrance inside Euston station serving both lines, the two separate station entrances outside closed in 1913. The Bank-branch building was demolished in 1934, but the Charing Cross branch building survived. That building was gutted internally in the 1960s to provide space for a ventilation fan and an electricity substation. However, although it's still in use pulling hot air out of the tunnels, it is also sitting right in the middle of the planned HS2 station at Euston. In fact, it's where the platforms will be, so it had to be moved.

HS2 Euston tunnel. Photo by Monica Wells

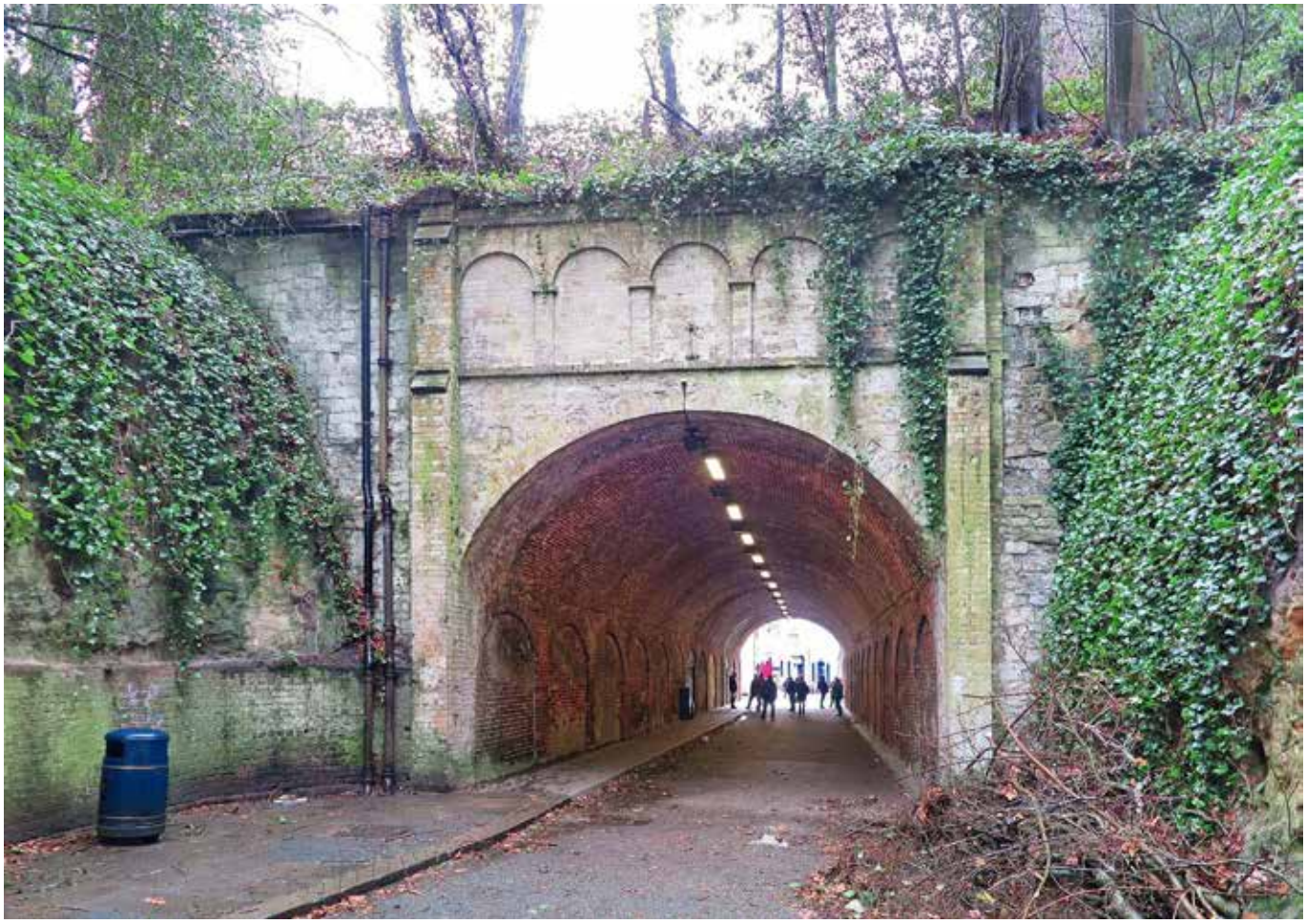
And that is why HS2 is building a replacement building, known as a Traction SubStation (TSS) on a side street to the south of the station. As explained by Rob Williams, senior project manager at the Mace Dragados JV that is carrying out the construction work, the new building will provide ventilation and electricity for the Northern line, but to get those from the new building to the Northern line, they had to dig a 90-metre long tunnel.

Digging the tunnel and the new box proved to be a challenge, not least because it's right in the middle of central London and surrounded by lots of other occupants, so noise, dirt and deliveries all needed to be managed to reduce their impact on the residents, but also because the tunnel had to avoid affecting the Northern line just beneath it, a high power electricity tunnel just to one side and major water mains to the other. The work was described as threading a needle to squeeze the tunnel in the narrow gap between all the other tunnels down here.

SOURCE: *Ian Visits* website, 2 August 2022

Return Visit to Reigate Caves, Surrey

Jennie and John Lill



Tunnel Road facing south

On a rather damp Sunday in February we gathered in Reigate on Tunnel Road to start our exploration of the Reigate Caves. We were met by members of the Wealden Cave and Mine Society who accompanied Sub Brit visitors along with members of the public around both sets of caves.

This visit report follows previous ones by Sub Brit with information in the archive on the Barons Cave by Peter Burgess (01 July 1990) and a detailed article on the area's mines and geology by Paul W Sowan (*Subterranea* 32, April 2013).

Tunnel Road is the oldest road tunnel in Britain and was built in 1823. It was designed as a short cut on the main London to Brighton road and we were reliably informed that any connection to the Prince of Wales's involvement for romantic liaison purposes is most likely an urban myth. It was in essence an early bypass for Reigate town and was used as a main road until it was itself bypassed and pedestrianised in the 1970s.

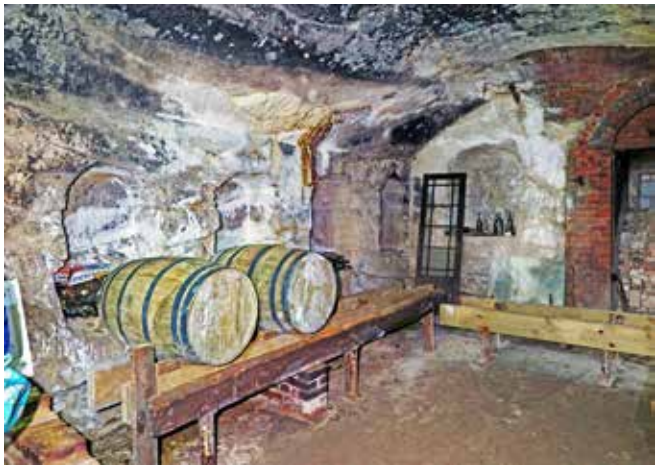
Tunnel Road East

It is thought that these caverns were dug around the time the road tunnel was opened. This section of the tunnels has in the past been used as an air-raid shelter, wine stores

Bunker door rescued from Town Hall nuclear bunker

and toilets, but never as a mine. The bunker door was installed in the caves by WCMS having been rescued from a nuclear bunker that was built nearby under Reigate Town Hall, although it is safe to assume that some form of security barrier was in place when the area was used as beer and wine vaults.

The brick vaulting indicates the purpose of storage and records show that several companies used the site up until 1914. The area is now being used once again for beer storage with local brewers Pilgrim Brewery storing six 40-gallon oak barrels to age a special stout for six months which will then be bottled and sold locally.



Oak barrels used for ageing beer

Tunnel Road West

Mining was undertaken sometime between the road tunnel being built in 1823 and the main collapse in 1853. There is evidence of two stages of mining which may have caused the collapse as they dug down from the first level. The central section collapse was so severe it blew the doors off the entrance.

The original sand mine was created directly off the main Tunnel Road. They mined silver sand which was primarily used in the nineteenth century in horticulture and was all dug by hand. By 1914 it was out of use as a working mine,

During WWI the mine was used as a bonded store until in 1916 it was requisitioned by the Ministry of Munitions as an explosives store. It is now believed that tunnels on both sides of the road were used to store munitions, because a timber floor was also discovered in the eastern section. The facility was decommissioned in 1919 when a local auction was held.

The mine was then disused until the 1930s when a local rifle club moved in and the Mayor encouraged public entertainment and events to be hosted in the main caverns.

During WWII the mine was converted to a residential air-raid shelter for around 150 people. There is still evidence of the two gas screens used to form an airlock system installed along with notations of occupancy and a graffiti image of Hitler. The shelter was in existence until the end of the war in 1945 after which the rifle club moved back in.

Target area of one part of the firing range

Graffiti evidence of WWII use

Graffiti image of Hitler. Photo Tim Wellburn

An exit originally opened during WWII has been reinstated following a mines inspection. This emerges outside the tunnel and provides a way out in an emergency.

Reinstated emergency exit

Following our exploration of the well-used sections of the caves we proceeded through the back of the original sand mine to an area not recently utilised. This section had to be cleared of broken glass! During the 1950s children would routinely collect glass bottles to return for money which included beer bottles.

In order to stop them selling back the beer bottles the breweries broke them up, placed them in beer barrels and dumped the beer barrels in the nearest location which happened to be the Reigate Caves. Over time the barrels have rotted, leaving smashed bottles and glass throughout the mine.

Broken glass from the floor of the cave

In order to clear this debris it was necessary to dig down between 0.3m and 1m and then sieve the sand to remove the glass and return the sand to the cave. There is also a variety of graffiti in this section of the cave, some dated to 1915.

Graffiti on the cave walls

To continue and subsequently complete our tour we proceeded though the new tunnel dug in October 2021 (with financial support from Sub Brit). The tunnel was required, following a mines inspection, to provide a secondary exit from the system.

New tunnel to provide alternative exit route

This new tunnel starts at the back of the cave in a section not mined previously, and was taken through solid wall. As the work progressed the end point was changed in order to avoid a narrower pillar section. The works were completed in five days by three men using a hand-held electric breaker with a chisel end. The sand removed from the tunnel was used as additional material for the floor of the mine area to supplement the cleaned and sieved sand.

The new tunnel emerges into a target area of the firing range

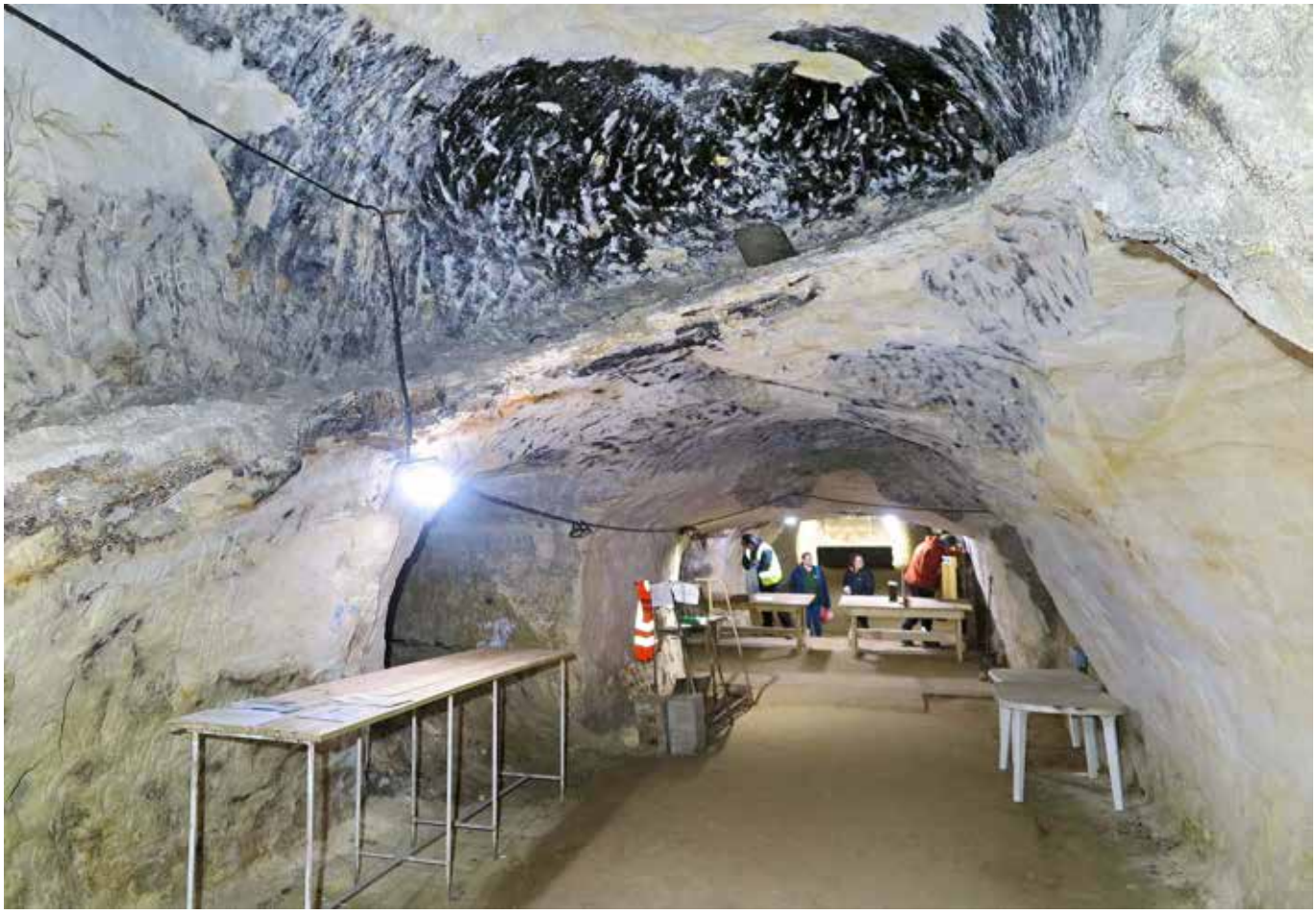
This new tunnel emerges into the firing range and creates a loop in the caverns with the unintended consequence that circular tours can now be run. This part of the firing range is located at the previous starting points for tours where the original sand mine entrance was located.

All images by Clive Penfold unless otherwise stated.

Further information

Paul Sowan: www.subbrit.org.uk/sites/reigate-caves

Peter Burgess: www.subbrit.org.uk/sites/barons-cave



Entrance to the sand mine

Danish Regan Vest government bunker to be opened

Poul Holt Pedersen

To the untrained eye the entrance just appears as one of the countless munitions storage bunkers that are found in Rold Skov, and in a lot of other forests in Denmark, but the entrance has some special features. It leads to a long tunnel beneath the hill and into the facility's core.

Next year in 2023 you can visit one of the most interesting Cold War museums ever – the Danish government's nuclear bunker Regan Vest in northern Denmark, about thirty kms south of Aalborg. Two brothers – Poul Holt Pedersen and Karsten Hvam Pedersen – have already written three books about the bunker. This is their story, and the story of the Regan Vest bunker, told by Poul Holt.

Dedicated to bunkers

In 1994 my brother and I happened to talk with a man who told us that something top secret existed in a forest in Jutland. He did not disclose more than that. One might think that we would probably forget the remark quickly, but this was definitely not the case.

For more than two decades we searched for information concerning the secret in the forest. We felt that it was a military installation, and the shroud of secrecy only made everything much more interesting. We slowly gathered pieces of information, often contradictory.

Denmark's deepest and best kept secret turned out to be disguised as an idyllically situated private house. We had been there many times without knowing what lay hidden in the back yard. Only recently the authorities opened up and told that a relocation facility for the Danish government and Royal House existed. However, the actual location remained secret.

We then requested access to see the facility, as well as information for writing a book about the preparedness of the civil sector during the Cold War. Following dialogue and negotiation, and to our great surprise, the request was green-lighted. As a result of the book, the Regan Vest bunker was written out of the secret emergency plan and became a museum. Getting to know this resolute and exceptionally constructed nuclear bunker certainly became one of the highlights of our lives.

Preparedness

Denmark had prepared for its doom in detail. After digging into the documents, we discovered that most planning was initiated by NATO. That is why we decided to write a book about NATO's civil plans for World War III, with Denmark and Regan Vest as the case history. But the book also describes the bunker for the United States

Senate and House of Representatives as well as Canadian bunkers, West German, British and more.

Thinking the unthinkable

Since the 1950s, the idea has been that the purpose of a military defence was for the present only, if there was a society to defend. The defence of the NATO countries was no longer regarded as an exclusively military task, but in a wider national context where all resources are mobilised in order to maintain a well-organized and capable society for the protection of the civilian population and the defence of the country.

During the Cold War, large parts of the world prepared for the unthinkable: a nuclear war where the survival of society was at stake. NATO expected member states to build secret nuclear-proof government bunkers and prepare a community that could function during states of emergency and under the worst possible conditions. The civilisation balanced on the edge of nuclear annihilation.

Democracy most compressed

Behind a well-hidden and guarded door, a half-kilometre-long tunnel leads to an underground backup of the Danish capital built to withstand nuclear weapons and to remain completely independent of the outside world.

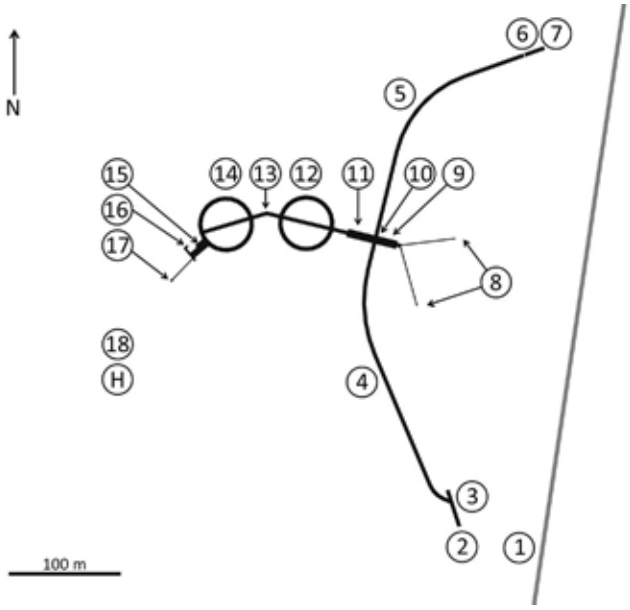
This bunker is constructed in a way that knows no equal in Denmark, and which will probably never be surpassed. With its own water and power supply, hospital, radio studio and conference facilities, the country's democracy in its most compressed form, and the most important institutions, could be maintained from this underground 'city', if Copenhagen's ministries became too unsafe or even were destroyed during a war.

Several decades after its construction, the bunker appears almost as when it was built. At a moment's notice, the facility was ready to accommodate the country's key figures: the Danish government and Royal House, as well as the top officials appointed to assist the government in leading the country before, during or after a war that has left the country devastated. The Danish Prime Minister's Office, Ministry of Foreign Affairs, Ministry of Defence, Ministry of Justice, Ministry of the Interior and many others practised in secret how to lead the country from the facility, if necessary.

The following describes the underground bunker with the code name ***Regan Vest.*** Upon completion, the facility was a giant of 5,500 sq m in area, making it one of Denmark's largest and most expensive buildings,constructed and operated in deepest secret.

Location

Regan Vest is situated in the northern part of Denmark. The geology in this area is rare, with a hard and shock-absorbing underground that would protect the facility well against bombs. At the beginning of 1961, drill tests were made to ensure that the underground was suitable for the purpose and on 24 January 1963, the permit to go ahead was granted.



The above illustration shows the facility's layout. The particular parts of the facility are numbered and described below:

1. *The house by the road, hiding the bunker*
2. *The entrance (Building A)*
3. *Reflector in case of an explosion*
4. *Tunnel I*
5. *Tunnel II (emergency tunnel)*
6. *Building B*
7. *Primary emergency exit*
8. *Two exhaust towers*
9. *Engine room (Building C)*
10. *The junction*
11. *Building D*
12. *Ring I (two storeys)*
13. *Central tunnel*
14. *Ring II (two storeys)*
15. *Ventilation room (Building E)*
16. *Reserve intake shaft/emergency exit ('the rocket')*
17. *Main intake shaft/emergency exit (vertical steps)*
18. *Helipad*

Construction

In March 1963, construction began with laying out the building site just below the hill. The Defence Construction Service provided information on a 'need-to-know' basis only. Employees were therefore never told what it was that they were building. This was also the case for the project manager and the foreman, who did know the design plans, but not the construction's purpose.

Most workers initially thought that it was merely an excavation of a limestone mine, similar to one that already existed in the area. The facility was therefore often called the 'mine'. As the workers gradually realised that the excavation was done with great accuracy, more and more suspected that the project was very special. Due to the secrecy and the fact that the project constantly grew in size, and that concrete structures were made inside the 'mine' later, the workers could figure out that it was something with a special function.

Since the project manager, at the end of the construction phase, announced that he was moving to the USA, and when a digging operation of four deep shafts was completed at the same time, most believed that they had guessed the facility's purpose. It was, obviously, an American rocket factory that could launch rockets from the shafts to the Warsaw Pact countries!

Access to the main excavations went through a tunnel that was getting longer and longer as the work progressed. The tunnel had a limited cross section, which is why the transport of materials was only possible with the use of minecars. The first metres of tunnel were dug in the front of the hill, which consists of soil and loose lime. The tunnel therefore had to be supported in order to avoid collapses. A few metres inside, the ground turns to solid limestone, which had to be blasted away. As space was blasted free in the mines, enormous constructions were built in the vaults.

Protection

Regan Vest is more than adequately protected, since it is dug into a hill and therefore is situated beneath 50 to 60 metres of very heavy yet shock-absorbing limestone. That many overhead cubic metres provide formidable protection against bombs, but might not always suffice.

As the tunnel was excavated, it was therefore reinforced. The walls and ceilings were lined with rebar and curved iron profiles that were then sprayed with concrete. Shotcreting is a technique where concrete or mortar is sprayed directly onto the walls through the nozzle of a hose. The concrete adheres to the wall, plugs holes and seals the rebar.

The rings are excavated. The rolled iron profiles and laths are fixed in order to protect against falling pieces of limestone. The lower storey's walls and ceiling are being cast. The photo was taken in March 1965.

When the concrete is solidified, it makes the tunnel very durable. The two rings are protected in a completely different and exceptional way, because the excavations of the rings are much higher and wider, and therefore more vulnerable. After these excavations were completed, columns were built to support the ceiling and rolled-iron profiles were fixed.

The core of the facility is subsequently built inside the lime pits of the rings. Here, freestanding concrete structures are built for working and accommodation. After finishing the floor, the walls of the lower storey are built using rebar and wooden shuttering. In this mould, concrete is poured, encapsulating the rebar. When the walls of the lower storey are finished, the ceiling is cast in the same way. The upper storey of the rings is subsequently constructed in the same way as the lower storey, constituting a two-storey building.

Blast wave

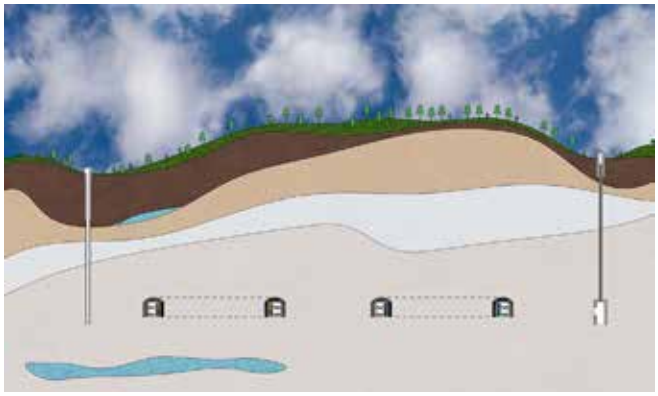
Bunkers are generally built to protect against, among other things, fragments from an explosion. However, if the bombs are large in the form of, for example, nuclear weapons, the blast wave of the explosion is more dangerous than the fragments, since the pressure causes internal bleeding. As a consequence, a blast wave can kill people without visible damage to the body.

Because a sufficiently powerful blast wave can move even a wall of reinforced concrete several centimetres in milliseconds, it is most effective to build a 'building within the building' – a kind of double hull in order to protect people and equipment from walls that are set in motion, and to reinforce the construction so that it does not collapse as a result of the ground shock. The design of Regan Vest, built deep underground and with a gap between the limestone and the structures, provides therefore one of the most effective methods of protection.

This drawing illustrates the construction of the rings. In the limestone excavations rolled-iron profiles are fixed in order to reinforce the ceiling. Between the iron profiles, laths are mounted in order to protect against falling pieces of limestone. The floor and a two-storey building are then cast in the cavities of the limestone.

Shafts

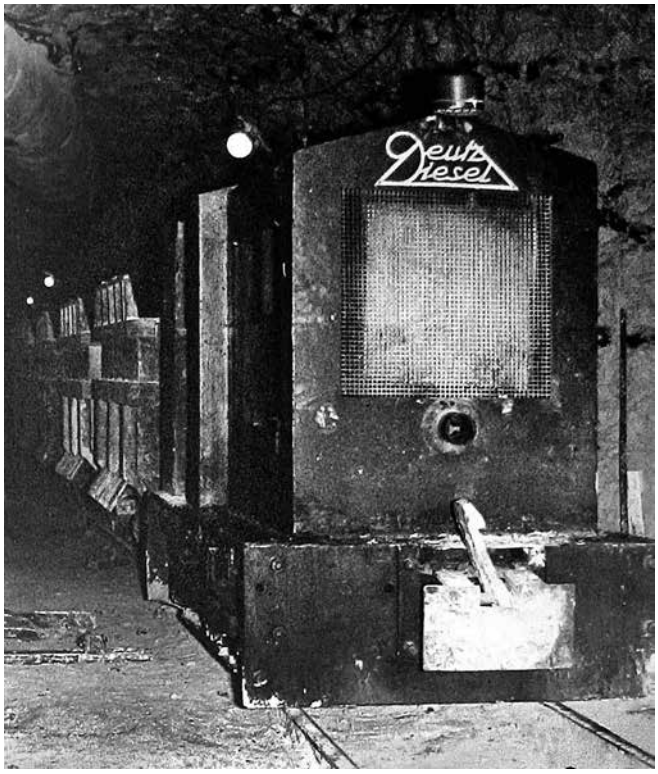
Shafts for the towers were dug vertically into the ground by a well-digging company.



This sectional drawing illustrates how deep underground the rings are built and thereby also the depth of the shafts. The rings are situated 50 and 60 metres down.

Work environment

In the 1960s the safety practices at building sites were not as well developed as they are today. The workers were supposed to wear a helmet, but often forgot about it. During blasts they hid behind the minecar train or other heavy equipment, situated just 10 to 20 metres away from the blasting site. The explosions could have caused a collapse due to the blast wave and shaking. Some workers pinched their fingers, and a few broke an arm or a leg.



A Deutz diesel locomotive hauling a minecar train

Construction death kept secret

It was dark inside the excavations. At least once the carts collided, causing a loud bang. The tunnel slopes slightly upwards in order to drain water from any water pockets instead of flooding the building, as well as to facilitate the minecar train in pulling out the heavily loaded carts of limestone. This caused a tragic accident when one day a minecar suddenly began to roll during filling it with lime. Worker Kristian Borup attempted to avert an accident of a runaway cart outside the tunnel by slowing the speed of the minecars with his own weight. Unfortunately he stumbled in the narrow emergency exit tunnel and got trapped under the cart, dying instantly due to severe injuries.

Colleagues removed the one-ton cart that he was pinned under and laid the body on a blanket before transporting it out into the open air. Neither the rescue personnel nor the doctor were allowed to enter the facility.

Kristian Borup's family was notified of his death by the family doctor. The Danish Defence Ministry kept a low profile in order to avoid media publicity. Nevertheless, the project leader (as the only one on behalf of the authorities) chose to attend the funeral at the Gravlev Kirke, but no one was told who the 'secret man' was. The authorities never contacted the family, so neither an official explanation nor compensation was offered.

Fifty years later, the family met the project leader again. Because the facility had been written out of the emergency plan, he was able to present himself this time and offer the long-awaited explanation of the death to the family.

Guardhouse

Over the years, one of the houses along the small road caused much speculation in the local area. The house was built as a 'smokescreen' for the bunker, as a guard, and service occupancy for the facility's workmen.

The guardhouse was a 'smokescreen' for the facility, adjacent to a quiet road and woods

Main entrance (Building A)

Inside the fence, there is a building well hidden by trees, the house and the garage. It is the main entrance to the facility, which is a reinforced concrete structure of approximately 70 sq m, the majority of which is dug into the side of the hill.

Along with military force protection, the outer police guard is the first serious barrier for unauthorised persons wanting to enter the facility during an exercise or relocation.

The police guard has a small window of armoured glass for looking out. Next to this window, there is a wooden door. If you were authorised to enter this door,

The main entrance to Regan Vest

you were received by the police officer stationed in a room just inside and to the left. In this room, visitors identified themselves and deposited cameras, weapons and I D cards. Next to the outer police guard room there is a shower system where you would first take off your contaminated clothes in one room, then you are washed in another room and finally get new clothes in a third room.

Tunnel

From the entrance one enters the tunnel leading to the facility itself, 300 m further inside.

As the tunnel excavation progressed, the cavity was supported. An iron lattice was made, and wooden shuttering added as formwork. Concrete was subsequently sprayed between the support and the shuttering, filling the gap and encasing the iron lattice. The rest of the tunnel. which was blasted out of solid limestone, is reinforced with rebar and is then sprayed with shotcrete.

The tunnel is lined with curved slats. The slats have several functions. The main function is to protect the long tunnel against collapsing. In addition, the slats also work to reduce the blast wave from a bomb and combined with the tunnel's several bends, they also stop bomb fragments, as well as projectiles.

The tunnel with horseshoe-shape profile and sprayed concrete lining

The junction

300 metres further ahead, far enough to need bicycles available for transport, is a tunnel intersection that is called the junction.

The junction. Left: The entrance to the airlock leading to the workplaces and living areas that are situated to the west of the tunnel. Centre: The emergency tunnel. Straight north (in Tunnel II), the primary emergency exit is 250 metres ahead. Right: The entrance to the engine room that is situated to the east of the tunnel.

Primary emergency exit (Building B)

The facility has three emergency exits, which have two purposes. They have to ensure that one can get in and out, if the main entrance is blocked by a blast or a siege, and they have to ensure that one can get in and out unnoticed, if the main entrance is presumed under surveillance.

The tunnel protects the facility's core by deflecting the blast wave of an explosion. A blast wave would be able to pass through the entrances and unimpeded through the rest of the tunnel, in recognition of the fact that no man-made obstacles can be made that are sufficiently strong enough to stop it. Therefore, it is also called a 'blow-through' tunnel.

The engine room (Building C)

The engine room and the facility's core (Building C), the workplaces and living areas in the rings, are physically separated on each side of the tunnel in order to prevent an explosion of the combustible fuels in the engine room becoming fatal for the bunker's residents.

The doors to both the engine room in Building C and the airlock in Building D are the first heavily reinforced doors in the facility. The doors are oversized vault doors. Each is 180 mm thick and made of 35m millimetre steel plates lined with fire-insulating concrete, poured in after the doors are installed. Each door weighs 2,500 kg, and a Herculean arm is consequently required to open it. The idea of the heavy blast doors is that they have to be at least as strong as the rest of the building in order not to constitute a weak point.

Inside Building C, in a smell of diesel and lubricating oils, two large 500-hp (587-kW) 8-cylinder diesel generators

take up most of the space. From the diesel generators pipes lead to two exhaust towers at intervals of 75 m that lead up to the ground surface.

The emergency generators and controls in Building C engine room

The facility is self-sufficient in water because it has no less than three water wells with a 1,500-litre storage tank each. The water supply, second only to the air supply, is the most important element of survival and is therefore secured indefinitely.

The airlock (Building D)

Opposite Building C, with the engine room, is the entrance to the airlock, leading into the facility's core, the workplaces and living areas.

A peephole and a telephone are visible to the left of the 2.5-tonne blast door, making it possible to communicate with the inner police guard if the blast door is sealed. The blast door is unlocked with a key. When the key is turned, you have to press the switch in the floor and turn the door handle simultaneously. Behind the blast door, there is an empty room, and then there is another blast door. The two blast doors must not be open at the same time to prevent a blast wave of an explosion from gaining unimpeded access into the facility itself. After that there is a gas-tight airlock, which makes sure that the overpressure does not leak out.

Central tunnel

From the airlock, the central tunnel leads to the secondary emergency exits situated 200 metres away.

Here, at the top of the plan 'number eight', you find Building E housing the facility's oxygen supply and the two secondary emergency exits.

The central tunnel is so long that scooters are available for transport. In total the bunker has nearly two kilometres of passages

Ring I – The work ring

After passing the airlock, you reach Ring I at the bottom of the plan 'number eight'. The two rings, which together form a figure of eight, are designed to accommodate 350 persons at the most. During a relocation, about 200 persons were expected from the government, the ministries, some of the committees and the Royal House.

In order to accommodate these residents, Regan Vest's staff had to be expanded to nearly one hundred individuals, consisting of specialists in communications, the facility's layout and technology, but also police, doctors, nurses and administrative staff. The facility has approximately 220 workplaces with a table, chair and, usually, a telephone. Most of these workplaces are located in Ring I, which is accordingly called the 'work ring'.

In the first quarter circle are the Ministry of Defence rooms that consist of a conference room and a number of offices, which would usually accommodate four workplaces each. During a relocation, the Ministry of Defence would bring the Minister, the Ministry's top officials, the Defence Command, the Home Guard Command, the Defence Intelligence Service and the Maritime Safety Administration. The operational warfare was never meant to be waged from the government facilities that are purely civilian facilities.

The Chief of Defence and parts of the Defence Command are present as military advisers to the government and to discuss operating conditions. During a crisis or war, the armed forces are furthermore highly dependent on a close interaction with the civil administration in relation to, for example, transport needs, rationing of fuel and food, receiving wounded in the hospitals and so on. The Defence Command is the link, which ensures this close interaction. The operational warfare for Denmark and its

immediate area, i.e. the practical leadership in war, would take place from NATO's Bunker 7, which is situated to the west of the city of Viborg.

In the farthest quarter circle are the government's most important rooms. Among other things, the semicircle includes the government's ministerial meeting room. The government normally meets in the Prime Minister's office at Christiansborg Castle for a "ministerial meeting" every Tuesday to discuss legislative proposals, proposals for parliamentary resolutions, presentations and other major government initiatives. During a national crisis or war, it is especially the latter that will carry weight, and it is then expected that the meetings will take place at least once a day.

Unlike the Prime Minister's meeting room in Christiansborg, Regan Vest's ministerial meeting room is covered with maps of Denmark and its regions, Europe and the World along the whole of one of the walls, since these maps make it easier to create an overview of the conflict that would have triggered the decision to relocate.

The conference table is oblong and seats about 18 persons. Furthermore, a few extra chairs can be set up along the end walls. In contrast to the ordinary ministerial meetings, spaces are thus made for the top executives of the Defence Command, the Civil Defence Directorate, the National Police, the Intelligence Services and others that become very important advisers to the government and executive authority on behalf of the government during a national crisis or war.

Council of State

The same meeting room can also be used for the Council of State. The Danish government is not capable of governing without the presence of the monarch, since all laws and important government measures under the Danish Constitution must be negotiated in the Council of State. The Royal House has four rooms next to the Prime Minister.

Due to the rings' limited diameter and the strict demands for reinforcing the structure's ceiling in the event of collapses, it is not possible to build meeting rooms that can accommodate all of the participants whose presence may be relevant . Above the table of the main meeting room there are, therefore, microphones, allowing the subordinate staff, who were to provide supplementary material and implement the decisions made, to listen from the adjoining meeting rooms.

A meeting room adjoining the main meeting room.

The Prime Minister's combined room for resting and sleeping with the opportunity to also work a bit in peace and quiet. The bunk bed in the room is shared with the Permanent Secretary.

Corner offices and sitting room for the royal couple. The Monarch is the only person who can bring the "other half" during a relocation.

The Bunker Command had two doctors and six nurses from public hospitals. The facility therefore has a small hospital with examination couch, X-ray equipment, etc. One of the two doctors had to be an experienced emergency room doctor, who could diagnose and treat the most common disorders. The other doctor had to be a psychiatrist, who could treat psychological reactions to crisis including anxiety, self-reproach and anger.

Next to the examination room is a care unit. Patients had to lie in bunk beds, which could certainly be said to be an ergonomic challenge for both patients and nurses. There are nicely folded ready-to-use blankets on the beds. In the closet, patches, gauze and syringes are neatly arranged on shelves. Crutches are ready.

Other residents

Denmark has a constitutional freedom of religion. Since the majority of Denmark's population are members of the National Evangelical Lutheran Church, a chaplain was designated. The chaplain's most important duties in a government facility were to hold Sunday observance and to assist with the personal dilemmas that residents would no doubt face during a relocation. The residents, for example, do not bring their families, who are thereby left to an uncertain fate, while they remain in safe surroundings themselves.

The police were to be represented by six police officers during a relocation. In addition to the task of enforcing access control to the facility, the police officers also had to maintain due calm and order. Up to once a month, officers visited the bunker in order to inspect the equipment, but just as much in order to keep in contact with the permanent staff, being their closest partner during a relocation to the facility.

In the northern side of Ring I's upper storey, it has previously been described how the Ministry of Defence is located next to the government's conference facilities. Just beneath the government's facilities, the Ministry of Foreign Affairs has its premises, exhibiting clearly the two resource areas that are the government's most important interfaces and instruments of its leadership during a national crisis or war. The remaining ministries have only one or a few rooms, but both the Ministry of Defence and the Ministry of Foreign Affairs have almost a quarter of a ring each with workplaces and conference facilities. Each of the two ministries has seats for about 25 persons, while most of the other ministries only have seats for two or four including the minister himself.

The rest of the semicircle is dedicated to the communications centre. The task of the comms centre is to send and receive messages to and from the authorities in the government facilities. Approximately fifty communications experts were designated to relocate.

Media broadcasting

As a practical aid for communicating with the population, an agreement was made with Danmarks Radio (the Danish Broadcasting Corporation) and Ritzaus Bureau that journalists from the two organisations would relocate to the facility. The journalists' task would then be to inform about developments in the country, communicate the latest decisions, inform about alarms and possibilities for protection and other important information. The purpose of the major communications effort was not only to inform the population about developments, but also to provide help for self-help and to prevent panic by showing the population that the government is still capable and has retained control.

From the radio studio, a "doomsday" speech was prepared from the Prime Minister to the population. In the speech, the population was informed that World War III had become a reality and that Denmark is resisting. The speech contained the quote, "Now there will be much to do and much to go through for all of us." In addition, the Prime Minister urged the population to remain calm and display due care as well as follow the instructions given. He also stated that Denmark's armed forces are ready and that reinforcements have been added, and that more are en route.

Part of the communications studio facilities

The high-tech communication equipment is placed on rubber shock-absorbers in order to prevent the shaking of an explosion from propagating into the sensitive equipment. The system is also protected against electromagnetic interference (EMI), *and electromagnetic pulses* (EMP) *which are triggered by 'jamming' or a nuclear explosion. EMI and EMP can damage electrical circuits even at very long distances.*

Ring II – The residential ring

For general relaxation there is a large and cosy lounge in Ring II with armchairs, tables, chairs, radio and television, movie player, board games, newspapers and a bookshelf. Here, the residents and staff could retreat and relax, if there was no work to do. The upper storey's southern side contains the kitchen and canteen.

The lounge. It had to look like any other weekday, but there has never been an ordinary weekday in Regan Vest. And there would never have been a weekday in the facility, if it had been activated.

The canteen

Bunker Command

The Bunker Command staff is expanded from four in peacetime to approximately fifteen persons during a relocation. The expansion is made in order to keep the facility running 24 hours a day, and because of the increased workload that accompany the many residents. The expanded staff consisted of police officers, Defence Construction Service workers, recalled reserve officers – e.g. the Bunker Commandant or wartime commandant, who was colonel of the reserve, an ABC (Atomic, Biological and Chemical) officer, etc..

Persons of the expanded staff that needed to go to the facility often went on a Tuesday. The maintenance work was then carried out, communication systems were checked, emergency exercises performed, and suchlike. The Bunker Command comprised approx 93 persons when including everyone in the staff – Lottas (Lotta Corps voluntary defence operatives in Denmark), Home Guard personnel, technicians, communications experts, doctors, electricians, artisans and conscripts.

Food

The facility has two freezer rooms, two storage rooms and a room with rations that last for a long time. Prior to a relocation, the facility staff would always try to purchase fresh food and stock the freezer rooms. This was done in order to stretch the rations, but also since the culinary experiences of the armed forces' rations are rather meagre and the food quickly becomes wearisome.

The ventilation system (Building E)

Farthest to the west, and accordingly farthest from the junction, is a ventilation system. In this wing there are installations built to ensure the air quality in the facility. Most vital for staying in the facility is clean and uncontaminated air with a limited amount of carbon dioxide (CO_2).

The intake of air takes place through two intake towers. Since the intake shafts draw air in, and do not blow dangerous exhaust gases out, they have been given

When Erik Larsen-Ledet retired as the chief of human resources of *Dronningens Livregiment* (the Queen's Life Regiment), Major Bengt Landors Christensen took over the job. When Christensen retired, Major Hans Simonsen took over. When Erik Larsen-Ledet retired as commandant of Regan Vest, Major Bengt Landors Christensen took over the job. Then when Christensen retired, Major Hans Simonsen took over the job. Coincidence? Most likely not….

Vacancies in the Bunker Command have never been advertised; neither the civilian nor the military. The facility was far too secret and too important to do so. The persons were therefore hand-picked. Police Commissioner Poul Tradsborg, who was responsible for the police in Regan Vest, was also a childhood friend of Hans Simonsen.

Per Munch Jensen was in the regiment staff. One day, he was asked if he wanted a new job as a senior sergeant. Jensen recounts:

"*I was not told anything about the job or Regan Vest. I did not even visit the facility; not until after I had accepted the job. The entire business was a bit shady. When I took the chance and accepted, I had a chat with Hans Simonsen about the practical details of switching regiment. Simonsen was then the regiment's chief of human resources and later became my commandant in Regan Vest. I have no idea of why I got the job, but it was probably because I simply was who I am, and not because of my skills as a driving licence examiner. Christensen picked me up and gave me a tour. It was an extraordinary experience.*"

Jens Worker Kjeld Krogh Jensen lived next door to his predecessor in the job.

At one point, artisan Alfred Nielsen's wife realised that she would not go to Regan Vest if a war came. She therefore joined the Lotta Corps and would nevertheless come along. Their neighbour's wife joined the Lotta Corps as well.

One day, Christensen pondered "*What do we say to our family, if the alarm is raised?*" The Bunker Command, the Lottas, the technicians, etc., each told their own lie.

"*I therefore sat down with PET (Danish Security and Intelligence Service) and FE (Danish Defence Intelligence Service) and discussed the issue. I told them that we already had different craftsmen inside the facility, so why could we not also invite our 'better halves' in there in order to create some sort of understanding about our workplace? They went along and I arranged it. Not everyone invited their wives and husbands. I can only guess why. When my wife and I came out of the facility, we agreed that we forget the experience again, forever.*

"At one point there was a large exercise in the facility. I was walking in the hallway and suddenly my son approached me from the opposite end of the hallway. I was surprised and asked: 'What are you doing here?'

"He was amazed and replied, 'What are ***you*** *doing here?' It turned out that my son participated in the exercise as an orderly in the staff company. I had not told him where I was working, and he had not told me where he was going on exercise. After all, we had both sworn that we would not tell.*"

Christensen had a month's overlap with his predecessor, who was about to become a pensioner. When he met him on his first day of work, he had another surprise. He knew his predecessor, Mogens Frederiksen, very well.

another important function. They are also alternative emergency exits.

If the air has not been sufficiently cooled in the stone filter, it is first led into a large two-storey cooling tower. In the cooling tower, water is sprayed onto the air in order to lower the temperature. Since the particles in the air bind to water, the cooling tower can furthermore reduce the risk of airborne radioactivity. If the concentration of contamination is high, the staff will shut off the intake of air completely. In that case, the air already present in the bunker will be recycled and recirculated.

In order to extract the carbon dioxide from the exhaled air, an absorption system has been installed. The absorption system consists of a large tank which is filled with soda lime (a mixture of alkaline hydroxides) and water. The air is then blown through the mixture, extracting the exhalation gases from the air.

Opening again next year

The facility was delivered by the Defence Construction Service to the Secretariat of the government Committee on Civil Preparedness on 7 May 1968. The Regan Vest Museum will open in 2023.

For more information
see www.reganvest.com and
www.facebook.com/governmentbunkers.

See also Regan Vest book review on page 30.

In the main intake shaft (farthest from the facility), there are 269 vertical steps all the way up to the concrete structure on the surface. The shaft has a width of only one metre, with no lighting. In the reserve intake shaft (closest to the facility), a solution has been made which can be used if any of the residents were injured, unconscious or lacking the physique required to be able to climb to the surface. At hand is a 'rocket' which is a steel pipe that a person can just squeeze into for transport.

Meet the Committee – Phil Catling

I have been a Sub Brit member since 2010, when Chris Rayner arranged a visit to the Stockport Air Raid Shelters on the Manchester study weekend and I was your guide. The horde of members who descended and their tales of amazing visits and talks inspired a quick membership application.

Since then, I've spoken on underground topics many times at Sub Brit's Spring meetings and study weekends, as well as contributing to our 'In-the-Dark' webinars during the pandemic.

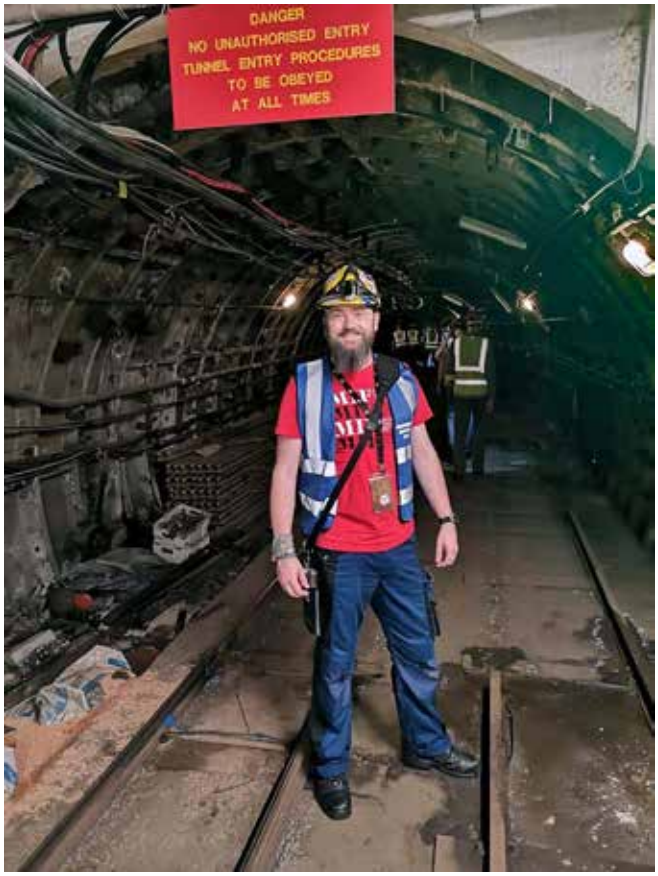
A committee member since 2014, I'm a familiar face hosting the Spring and Autumn day meetings, alongside arranging the speakers. I'll also be hosting the Manchester SubPub evenings from December.

I am also part of our social media team, helping to keep Sub Brit active and trending on Facebook, Twitter and Instagram.

A 'regular' on our visits across the UK, I contribute to the range and variety of these by organising underground trips for Sub Brit in the Northwest. Being trained and certified in High Risk Confined spaces, I regularly assist underground sites with risk assessments, health & safety questions and technical issues.

I ran the Stockport Shelters and other heritage sites for fourteen years before leaving in 2019 in a rather ill-timed move to freelance underground tours, talks and shenanigans as tunnelinspector.com.

Since then, I have worked for the Imperial War Museum, Manchester International Festival, International Language Schools, and festivals across the Northwest



as an activity leader and volunteer manager, with a move to St John Ambulance during the pandemic.

All these organisations have reported a mysterious but significant increase and interest in subterranean locations for tours…

Sarajevo's 'Tunnel of Hope' 1993–96

Stewart Wild

Refurbished section of tunnel is well lit

Earlier this year, after a trip to Slovenia and Croatia, I ended up at Sarajevo in Bosnia-Herzogovina. This was a city I had always wanted to visit since it came to prominence by hosting the 1984 Winter Olympics (when Torvill and Dean did so well).

Of course, it was well known before that as the approximate historical border between the Ottoman Empire and the Holy Roman Empire and the place where anarchist Gavrilo Princip shot Archduke Franz Ferdinand in June 1914, the assassination that sparked the appalling four years of carnage that was World War I.

The other reason I was anxious to visit this city was that it had an interesting tunnel to explore.

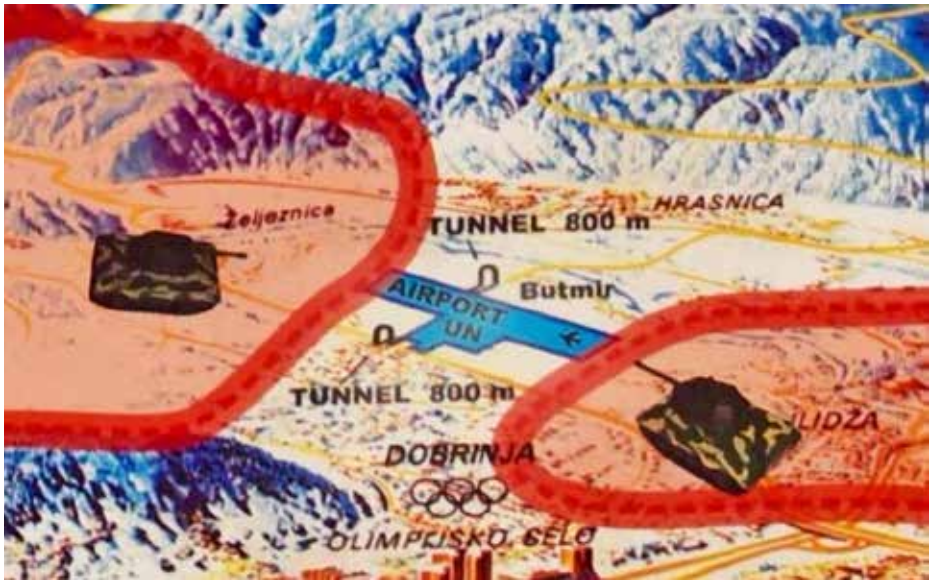
Background

Towards the end of the Cold War, the communist and multi-ethnic federation of Yugoslavia, created and held together by Josep Broz Tito (1892–1980), began to fall apart, hastened by the declaration of independence by Catholic Slovenia in June 1991. A few days later the republic of Croatia, also largely Catholic, followed suit, and was attacked by the Yugoslav People's Army, comprised mainly of Bosniaks and Serbs.

The United Nations became involved but was largely ineffective is sorting out an immensely complicated situation where vicious local warlords took over neighbouring territory and encouraged ethnic cleansing of historic and religious minorities.

Sarajevo, a city of some 325,000 inhabitants, lies in a bowl at 1,800 ft a.s.l. surrounded by hills and mountains that reach nearly 7,000 ft. The city lies on the banks of a shallow river that flows into the Sava and joins the Danube at Belgrade. Sarajevo's airport is some distance from the centre, in the southwestern part of the city.

The war escalated in 1991 when Bosnia-Herzogovina declared independence opposed by Serbia. The Serb Army invaded and laid siege to Sarajevo, occupying the high ground all around while it shelled the city from a distance. In April 1992 the European Union recognised



Sketch plan looking southwest

Bosnia's independence and United Nations forces arrived, taking over the airport. The surrounding Serb army, with a ring of armour 65kms around, laid siege and intended to starve the multi-ethnic city into surrender.

A city under siege

The Bosnian Army had control of the city and a narrow corridor to the southwest, on the other side of the airport and its main runway. Brave citizens took to running across the runway, carrying messages and smuggling essential supplies like medicines and cigarettes. But many were killed or injured by artillery and snipers; thus in early 1993, out of desperation, the idea of a tunnel was born.

Known secretively as D–B (Dobrinja to Butmir), it was a very ambitious project. The tunnel and access trenches had to be dug in secret, by hand, without being spotted by the surrounding Serb artillery. An old house on each side of the runway was selected as a starting point for the diggers; shovels, pickaxes, buckets and wheelbarrows were their only tools to start with. The tunnel itself is 340 metres long, augmented at each end by deep covered trenches; its total length is over 800 metres.

Private house concealing Butmir end of the tunnel

Constant shelling destroyed most of the city's infrastructure, leaving the desperate citizens with no water or electricity, no telephones, ruined houses and public buildings, dwindling food and medical supplies, no transport and all the problems associated with a mounting death toll.

Digging continued 24/7. The deepest point is five metres below the runway. Water ingress was a constant problem; pumps were installed with limited success. It seems incredible but on 30 July 1993, after only four months, two diggers met under the runway and the 1.60 metres high, one metre wide tunnel was complete. In bad weather it often flooded. Countless trees were felled to provide boarding and pit props.

Video presentation in exhibit room

It was no easy task for a man carrying up to 50kgs of food and supplies to negotiate the tunnel all the while in a crouching position. Soon hundreds of people were passing in both directions; passing places had to be provided. Trolleys were commandeered or constructed; soon rails were laid down to permit heavier loads and speedier passage. The ordinary-looking houses at each end of the tunnel were fortified and guarded at all times.

Astonishing statistics

Up to four thousand people used the tunnel each day – overall there were several million transits. Injured people were evacuated by being carried on a helper's back. Army officers, a few trusted journalists and politicians used the tunnel too, and, it was said, United Nations personnel when the airport was closed. Even President Izetbegović made a transit, carried in a special chair.

Thousands of tons of food, ammunition, weapons, petrol and commercial goods were smuggled into the city. Cigarettes were a common currency. Needless to say, there was a thriving black market. After a pipeline was installed millions of litres of diesel fuel were pumped to help keep the city alive.

Stairway access to tunnel at southern end

A telephone cable was installed to improve communication with the outside world. Men from the electricity supply company working mainly by night managed to connect up a high-voltage power supply into the city from a power station over 30kms distant.

Tunnel is reinforced with wooden boards and tree trunks

The tunnel today

Visitors can enter the tunnel on the south side only, through the damaged house and makeshift museum complex in the suburb of Butmir. The visit begins with a 15-minute video presentation, then you view a variety of tools, weapons and equipment as you descend steps into the basement to enter a short length of the tunnel itself.

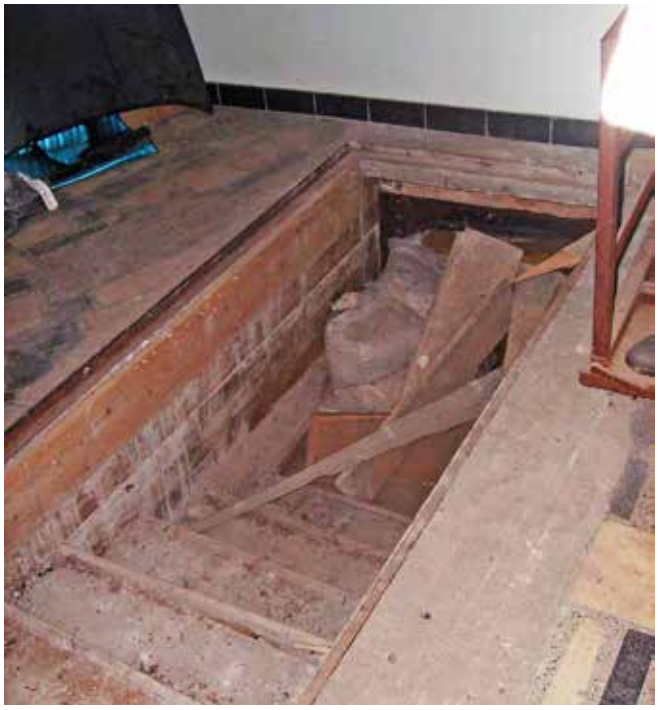
A further length of the tunnel of some fifty metres has recently been refurbished to aid the visitor experience, and from which you exit close to the airport's perimeter fence. I couldn't help thinking of the escape tunnels from

Model showing evacuation of the wounded by stretcher trolley

German WWII POW camps featured in movies like *The Great Escape*.

I asked how it was that the Serbs did not discover and destroy the tunnel. Apparently they knew a tunnel existed but failed to discover its exact location. Since then, part of the roof has collapsed under the runway and for the moment a complete transit is not possible.

Admission is 10 euros (cash only) and there are ample storyboards to provide pictures and further information. There is a shop but it was closed when I visited.



The north entrance to the tunnel on the Dobrinja side was located in the garage of an apartment building

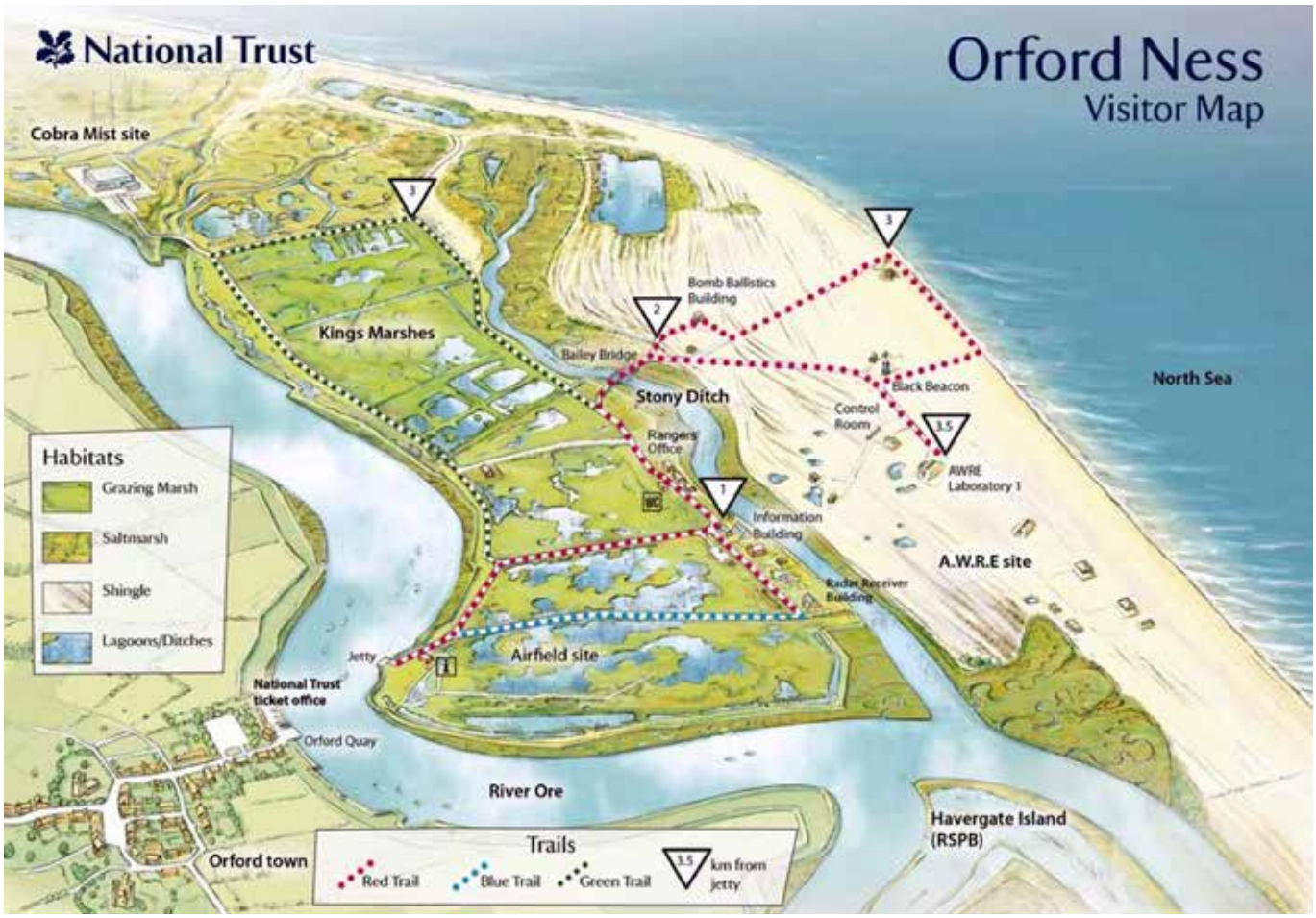
Aftermath

The war continued for over three years until the Peace Accords brokered by the Americans were drawn up in Dayton, Ohio, and signed in Paris in December 1995. Many of the warlords and army commanders were later convicted of war crimes.

The Tunnel of Hope remains a popular memorial to the 11,541 people who lost their lives during the siege, and to over 56,000 who were wounded. Above all is a tribute to the bravery, resilience and fortitude of the citizens of Sarajevo.

Sub Brit Visit to AWRE Orford Ness, Suffolk

Karrie Austin



Orford Ness. The map shows the crossing point from Orford Quay across the River Ore to Orford Ness, the location of the AWRE site, Cobra Mist, and other buildings viewed during our tour. National Trust guidebook for Orford Ness

Orford Ness is a spit of saltmarsh, shingle and grazing marsh habitat, approximately ten miles in overall length and up to half a mile wide, located on the Suffolk coast south of Aldeburgh. Being mid-May, the day was bright with some sunshine, though on an exposed coastline it was certainly breezy at times!

Historically, Orford Ness was used for grazing animals, but in 1913 the War Department purchased part of 'The Ness'. This was the start of the best part of eighty years' occupation of the area by the military, who later went on to acquire a greater area of this peculiar piece of coast.

Military history

The types of military activity at Orford Ness changed over the years as the nature of warfare also changed, though the focus throughout its history was mainly on the testing, development and trials of a range of rockets, bombs and ballistics, as well as experiments into communications and aerial defence.

During WWI, the arrival of the Central Flying School's Experimental Flying Section saw the start of military testing at Orford Ness. Early experiments into aerial photography, weather balloons, camouflage, parachutes and bomb sights were all conducted on the site.

The site of a WWI aircraft hangar, demolished in the 1950s after being damaged by a crane. It is perhaps surprising that it lasted so long, the flat coastal expanse of Orford Ness offering no shelter from the elements

After 1918, the military placed the Ness under care and maintenance, though this state lasted only until 1924 when the site was reopened to test and record the flight of bombs. Other experimental work during the interwar

years included a rotating loop navigation beacon, and early work on Radio Direction Finding (RDF), which was later named RADAR.

Following the outbreak of WWII, activity at Orford Ness focused on bomb ballistics and firing trials, including what was termed as 'lethality and vulnerability' trials. Essentially, these trials considered the vulnerability of aircraft to attack, sought ways to improve the protection of Allied aircraft against enemy attack, as well as seeking to improve the lethality of Allied ammunition.

After WWII, ballistic work and vulnerability trials continued as new weapons and machinery of war were developed. A range for testing rockets was also constructed, which used powered high-speed cameras to record the flights of experimental rockets.

One of the most intriguing episodes in the history of Orford Ness occurred during the Atomic Weapons Research Establishment (AWRE) occupation of a large part of the site from early 1953 until 1971. The Ness was home to the No 2 Explosive Ordnance Unit of the Royal Air Force between 1967 and 1985, after which the military all but withdrew from the site.

The AWRE elements at Orford Ness were the focus for our visit, although we had the opportunity to see the influence of both First and Second World War activities at the site, as well as those of the early Cold War period.

Sub Britters gather at the National Trust office at Orford Quay before taking the ferry

The National Trust takes over

Orford Ness was sold to the National Trust by the Ministry of Defence in 1993 as it was felt the site had served its military purpose. The National Trust recognised the importance of the habitat and species present and bought the site to protect this unique environment.

The Trust surveyed and categorised all the buildings present and realised that tough decisions needed to be taken on how to manage the site for the future. In the period between 1985 and 1993, no maintenance was carried out on the buildings, allowing the elements to take their toll.

The National Trust's philosophy at Orford Ness remains to enhance the area's ecological value and allow natural process to prevail, while still preserving the site's history where possible. Some buildings have been maintained and reused, but nature has continued to take its course with others.

This does mean that the AWRE buildings will gradually deteriorate further, although historic information and drawings of the buildings have been collated, ensuring records of these structures are kept for future generations. It is interesting to note that a majority of the AWRE buildings have been given Scheduled Monument status by Historic England, due to their rarity and unique designs.

Orford Ness was first opened by the National Trust to the public in 1995, with controlled access to protect the unique habitat and to prevent visitors straying into areas that could still contain unexploded ordnance.

The Sub Brit visit begins

The National Trust ferry Octavia *arrives at Orford Quay to take us across to Orford Ness. Photo Clive Penfold*

We gathered at the National Trust office on Orford Quay to meet our very knowledgeable and engaging guides for the day and to take the Trust's ferry *Octavia* across the River Ore.

Once safely across, we met our transport for the day, a trailer towed by one of the National Trust's trucks. As Orford Ness is sizeable, with the walking trails several kilometres in length, the opportunity to rest the legs between stops was welcomed!

Our first stop was the NT Information Building, a structure dating from WWI. This building was once the headquarters for the military, before being repurposed as an Energy Authority Police Station, then a telephone exchange. Today it houses temporary exhibitions, and we were able to see an historic aerial photograph of the site which included the aerial arrays associated with the experimental 'over-the-horizon' radar project *Cobra Mist*, which we were able to see a little later in our visit.

All aboard! Part of the Sub Brit group crossing the River Ore to start our tour. Photo Clive Penfold

Our transport for the day kindly provided and driven by our National Trust guides. Photo Pat Austin

A tour of the WWI and WWII buildings

After leaving the Information Building, we walked towards another of the site's WWI buildings, latterly the Radar Receiver building. This structure started life as an officers' mess then became a NAAFI. However, in 1935 it was utilised for a short time by Robert Watson-Watt and his team for early work on the system that later become known as RADAR, before this work was moved a short distance south to Bawdsey Manor.

The introductory board from the National Trust's Island of Secrets *exhibition, housed in the building once used for the early development of RADAR. Photo Pat Austin*

This building is now a display area, holding the National Trust's excellent and informative *Island of Secrets* exhibition. This offers detailed information and a timeline of the history of the site over the whole period of military occupation; a model of one of the AWRE laboratories built during the Cold War; and a preserved air-dropped nuclear bomb casing similar to those tested by the AWRE at Orford Ness.

The casing of a WE177A nuclear bomb, a type that would have been tested during the AWRE's time on Orford Ness. The casing sits in front of an information board explaining why laboratories were built on Orford Ness. Photo Pat Austin

In the area between the Information Building and the Radar Receiver building, it is possible to see the location of a now demolished WWI aircraft hangar, as well as the partial remains of an indoor model bombing range which was used to test small models of bombs and missiles. Still standing close to the Information Building is a WWI barracks, constructed from timber and concrete render with a later addition of a tin roof. This rare building is now used as a store.

The WW1 barracks building is located close to the Information Building. Photo Clive Penfold

We returned to our transport to carry on with our tour. We stopped briefly at a small collection of WWII-era buildings which have been repurposed for accommodation, and a National Trust Rangers' office, originally built in the

mid-1940s as a machine shop. Looking back towards the mainland, it was possible to see the remains of another WWI aircraft hangar and an area of land used for the bombing trials mentioned earlier.

This building dates from WWII and has been restored by the National Trust to be used as a Rangers' Office. The structure on stilts is a modern addition, mandated as a flood refuge. Photo Clive Penfold

Cobra Mist – in the distance

Our transport took us across the tidal Stony Ditch via a Bailey bridge. As we crossed the bridge, it was possible to see the remains of *Cobra Mist* in the distance. This was a top-secret Anglo-American 'over-the-horizon' backscatter radar project, started in 1963. It had a number of aims, including the detection and tracking of aircraft, satellites and missiles.

Cobra Mist consisted of a control building and, more strikingly, a field of tall aerials set out in a pattern which could be said to resemble a large fan. However, the project was closed down in 1973 due to significant interference which reduced its ability to operate effectively. The source of the interference was never found; the project ceased and the majority of the aerials were removed.

The grey control building from the Cobra Mist *project. Photo Clive Penfold*

The control building, which still remains today, continued to be used for radio transmissions, firstly by the BBC World Service and later by Radio Caroline. We were not able to approach this area of the site during our visit as it forms part of a breeding ground for nesting birds.

The AWRE Laboratories

After the Bailey bridge, the land changed from saltmarsh to shingle. This also marked the entrance to the area most extensively used for experimentation by the Royal Aircraft Establishment and the AWRE. As we drove towards the AWRE area the remains of Orford Ness lighthouse, demolished in 2020, were visible on the horizon.

Between its 1953 arrival on the site and 1966 the AWRE built six laboratories, or purpose-built test buildings, to assist in the development of Britain's atomic weapons programme. The laboratories were designed to mimic the wide range of conditions an atomic weapon and its components could experience during storage, transportation and operational use.

Essentially, these tests were to ensure the devices exploded only when they were supposed to! The laboratories could replicate extreme conditions of vibration, high and low temperatures, shock and G-forces.

Over the years the AWRE were present at Orford Ness, a range of devices developed as part of the UK's nuclear deterrent were subject to these tests, including Blue Danube, Red Beard, Yellow Sun and later, some of the WE177 series of air-dropped devices.

Looking across the shingle within the AWRE site towards Laboratories 1 and 3, with an ancillary building in the foreground. It is strongly advised to stick to specific routes due to the possibility of unexploded ordnance remaining buried on the site despite past clean-up operations

The design of laboratory buildings considered the implications of an accidental explosion, and ways to minimise the impact on the surrounding area. Thick reinforced concrete walls to help contain lateral blast, deep piled foundations and pits excavated to house the test areas were all included in the design.

Some buildings utilised a lightweight roof design, allowing a blast to travel upwards; others had a roof designed to help contain debris in a blast. It is still possible to see the banks of shingle piled up around the remaining laboratory buildings, another measure to absorb the shock

of an explosion. According to available official records, no nuclear material was involved in any of the tests and trials, but the accidental detonation of a device initiator would still have resulted in a significant explosion.

The exterior of Laboratory 1, with one of our guides unlocking the door to allow us to look inside. Explosion-absorbing shingle is banked around the exterior of the building. Photo Clive Penfold

Our next stop was the remains of Laboratory 1, built to house a vibration-testing facility. This building is partially derelict: most of the roof has collapsed leaving a skeletal frame, although the walls of the structure still stand with their exterior hidden behind shingle banks. Our guides unlocked the outer doors allowing us to walk part way into the building and view what is left of the interior.

Being open to the elements, to one side of the building a large pool of water had gathered, this being the location of the vibration testing area. A device, such as Blue Danube, would be brought into the building by crane and lowered into the pit where the vibration tests were then carried out.

The interior of Laboratory 1. The roof is now missing. The pool of water to the right-hand side has gathered in the pit where devices would be lowered for vibration testing. Photo Pat Austin

A short distance away from Laboratory 1 the remains of the control house could be seen. All testing was controlled remotely due to the danger of an explosion, with the control room being connected to the laboratory by underground cables. This control room was later modified to serve as a control room to an impact facility, or hard target, built in the early 1960s. The purpose of the hard target was to record on camera the impact of rockets propelled at its concrete walls using a rocket-powered sled. There are still some remains of the hard target today, located to the east of Laboratory 1.

A model of Laboratory 1 showing it as it would have looked in its heyday, minus its roof. The model gives an impression of how much of the building was buried in shingle to try and minimise the impact if a device were to have exploded during testing. This model is located within the Information Building. Photo Pat Austin

We moved on towards our next stop. On our way, we were able to see the remains of Laboratory 3, though it was difficult to make out much of this building due to its being covered by significant amounts of shingle. Once we learnt what tests were carried out here, the reason why became clear. This building housed climatic tests, exposing devices to extreme temperatures, both hot and cold. The buried nature of the building helped to control the environment inside, assisting with the tests being carried out.

A model of Laboratory 2 located in the Island of Secrets *exhibition. The entrance area is still visible today, although the building is not considered safe enough to enter. Information adjacent to the model sets out how devices would be tested using the centrifuge, and records that some tests were up to 1000 hours in duration. Photo Pat Austin*

Laboratory 2. This is similar in design to Laboratory 1, with both buildings constructed around the same time. The frame of the roof remains, with the shingle banks also still in situ. Photo Pat Austin

From our next stop, we could see the remains of Laboratory 2. Similar in style to Laboratory 1 though constructed with a more robust roof, this was also built in the 1950s to house a centrifuge to subject devices to G-force tests: essentially the huge acceleration and deceleration forces that could be experienced in service.

The device would be placed in the centrifuge, the building sealed, the centrifuge would start spinning to reach the desired speed whilst staff monitored and recorded results from a control building. We observed Laboratory 2 from the outside as it was not possible to enter due to its partially derelict nature.

Our tour then took us to the Magazine Building which we were able to walk through to view the interior. This building has a distinctive barrel-vaulted roof with shingle piled around the exterior of the structure and remains in a good state of repair.

The Magazine Building. Devices were stored in this building prior to be taken to the various laboratories to undergo tests. Photo Pat Austin

When devices built elsewhere were transported to Orford Ness for testing, they were stored in this building. The Magazine is constructed from reinforced concrete with a long corridor running the length of the structure, with two rooms off to one side. The building was fitted with a crane system to move ordnance and sealed with large blast doors at either end. Understandably, it was located a distance away from other buildings so in the case of an accidental blast, impact on the surrounding area would be minimised.

On leaving the Magazine, we were guided along a concrete track adjacent to the river. As we walked, footprints of demolished structures, various piles of rusting metal and blocks of concrete were visible, remains of the infrastructure once present when the site was in full use. There are many remnants and fragments of buildings dotted throughout the shingle, which reflect how the use of the site changed during the years of military occupation with buildings once needed becoming redundant and derelict.

Inside the Magazine Building. This view shows the corridor running the length of the building, with the two rooms to store devices located off to the left. Photo Pat Austin

The sheer scale of the area of Orford Ness utilised by the military is striking; when walking it brought this into sharper focus. It also acts as a reminder of how much emphasis was placed on the development of the UK's nuclear deterrent and non-nuclear weapons during the majority of the twentieth century.

The Pagodas

Our route took us to Laboratories 4 and 5, known as the Pagodas, which are certainly unique buildings. It could be said these two buildings are the most recognised ones associated with Orford Ness; being visible from the mainland. They were constructed later than Laboratories 1, 2 and 3, and marked a shift in the type of devices being tested here. As the WE177 series of devices were

Laboratories 4 and 5, better known as the Pagodas. These buildings could perhaps be considered as the two most iconic structures on Orford Ness due to their unique design.

developed, the existing laboratories were considered unsuitable for testing a new generation of devices, resulting in the construction of the Pagoda buildings.

View of one of the Pagoda buildings. Photo Clive Penfold

The pagodas were built using reinforced concrete, with a heavy reinforced roof supported by columns overhanging the footprint of the building. Inside, they were designed with a large central chamber where devices could be lowered by an overhead crane into a central pit for vibration testing. Three sides of the buildings are surrounded by shingle banks.

The spaces between the columns were originally fitted with perspex windows, designed to help dissipate the effects of an accidental explosion. In addition, the overhanging roof would have helped to direct any blast downwards onto the surrounding shingle, rather than allowing a blast wave to travel laterally.

As the Pagodas are considered structurally unsafe, we were not allowed to go inside, though were able to look in through one of the openings to get a glimpse inside. Completing our walk around the exterior, we were able to view a small cluster of buildings located a short distance away. This included the control room for the Pagodas.

As with the other laboratories, due to the dangerous nature of the tests they were all controlled from a remote location away from the building where the tests were being conducted. Another building, built partly from brick and clad in metal sheeting, was the Pump House, essentially a local fire station.

Though all the laboratories were specially built to test and develop the UK's nuclear deterrent, during the 1960s efforts were made to find commercial markets for the facilities here. With the WE177 series of nuclear devices and Polaris being utilised as the backbone of the nuclear deterrent, little new work was on the horizon, which led to the closure of Orford Ness.

The AWRE left the site in 1971, but RAF Ordnance

One of the Pagoda buildings, used to subject devices to vibration testing. The reinforced concrete roof and supporting columns are clearly visible. The building in the foreground would have housed plant associated with the tests carried out. Photo Pat Austin

Disposal teams remained clearing unexploded ordnance until the mid-1980s. However, given the long history of the site's use as a test facility there is still an air of caution about straying from the designated paths!

Our next stop was at an unusual-looking building, partially clad in wood, which could easily be mistaken for a windmill without any sails. Named the Black Beacon, it was built in the late 1920s and was first home to an experimental rotating loop antenna navigation beacon to carry out early research into RDF. This work did not last long before it was discovered that the signal from a ground-based beacon could be jammed, clearly not ideal for military use. However, the signal was successfully used for a period of time by commercial shipping.

Back to the 1930s

Further experiments into RDF were conducted here in the mid-1930s within the building which now houses the National Trust's *Island of Secrets* exhibition, which we visited earlier on our tour. When the AWRE took over the site this building was used to house telemetry to take readings during bomb trials. Today, it is used as a raised area for viewing the site. The Black Beacon is also home to a number of information boards giving a detailed history of the building.

The Black Beacon building. Early experiments into RDF took place here. The building now offers extensive views across the Ness from the viewing area on its upper level. Photo Pat Austin

View across the shingle from inside the Black Beacon's viewing area. Photo Pat Austin

Sitting adjacent to the Black Beacon is a small brick building known as the Power House. This powered the rotating loop antenna within the Black Beacon. Today it is home to displays telling the story of coastal processes around Orford Ness.

Our final stop was the Bomb Ballistics buildings. Built in 1933 and looking a bit like an aircraft control tower, it housed a range of instrumentation and cameras to record the flight of bombs. This information was then used to improve bomb aerodynamics, aiming and accuracy.

The equipment was continuously improved as technology advanced and was still in use during the AWRE's occupation of the site to assist with the development of atomic weapons, most notably during the development of the air-dropped WE177 series of weapons. Information boards on the first floor set out more details of the historical use of the building, with the roof space offering wide ranging views.

The Bomb Ballistics building. Information boards offer further details on the historic use of the building. The roof space now serves as a viewing platform. Photo Clive Penfold

In the area around the Bomb Ballistics building, it was possible to see traces of the narrow-gauge railway that crossed the site. The railway was used to transport goods and materials and, at times, the personnel stationed here.

Farewell to The Ness

Once back on the trailer, we made our way towards the jetty to catch the boat and return to Orford Quay. Looking back at the Ness from the mainland offered a good opportunity to reflect on our visit. Orford Ness feels like a place of contrasts. It holds multiple environmental designations and is an internationally important site for nature conservation.

This sits alongside its history as a military site where much of the work was so secretive that details are still being uncovered today. The area is covered by a range of buildings and structures, some derelict whilst others are well preserved. It is perhaps a matter of personal opinion as to whether these buildings are considered a blot on the landscape, or serve as an important reminder of significant periods in our history.

Orford Ness is well worth a visit to experience the feel of the place, to see the remaining structures and to learn more about some of what took place here during its long period of military occupation.

Acknowledgements

Thanks are due to David Gordon for organising our visit to Orford Ness and to the National Trust – particularly to our volunteer guides for showing us around, and for sharing their considerable knowledge of the history of this extraordinary site.

***Editor's Note**: A Sub Brit repeat visit to Orford Ness, organised by Dave Thomas and again hosted by the National Trust, took place later in the year.*

Loch Ewe gun defended area – Tracing the anti-aircraft battery remains

Sean L. Kinnear

The Gairloch AAOR in August 2001, when the building was still in use as a depot for the Highlands Roads Department. The original entrance porch has been replaced by the latge roller shutter seen here. Photo Nick Catford

Some of us have either visited or read about Gairloch Museum in the northwest Scottish Highlands since it opened its doors to the public in July 2019. The above-ground 1950s anti-aircraft operations room (AAOR), which once commanded the Loch Ewe anti-aircraft batteries as part of Britain's ROTOR air defence radar system programme, has been transformed from a decommissioned Cold War bunker (latterly used as a Highland Council storage depot) into a vibrant and successful multi-purpose community hub.

Imaginative award-winning recycling

Externally, the monolithic concrete structure is now faced with white render, concealing the overbearing blastproof walls, about two feet thick. Internally, visitors are free to explore a museum-cum-gallery space spread across two levels, and can enjoy lunch in the first-floor café with expansive views across Loch Gairloch with the Isle of Skye visible in the distance.

As well as winning the Art Fund Museum of the Year in 2020 Gairloch is also the newest college centre for the University of the Highlands and Islands. Here students can enrol on a wide range of full- and part-time courses and access high-end PC workstations with fast broadband, quiet study places and conference rooms.

Inside the Gairloch AAOR in August 2001. In the 1980s the balcony and all the rooms surrounding it were removed to create that tall room at the front of the bunker that vehicles could be driven into. Photo Nick Catford

Map showing 1950s ROTOR sites within Scotland

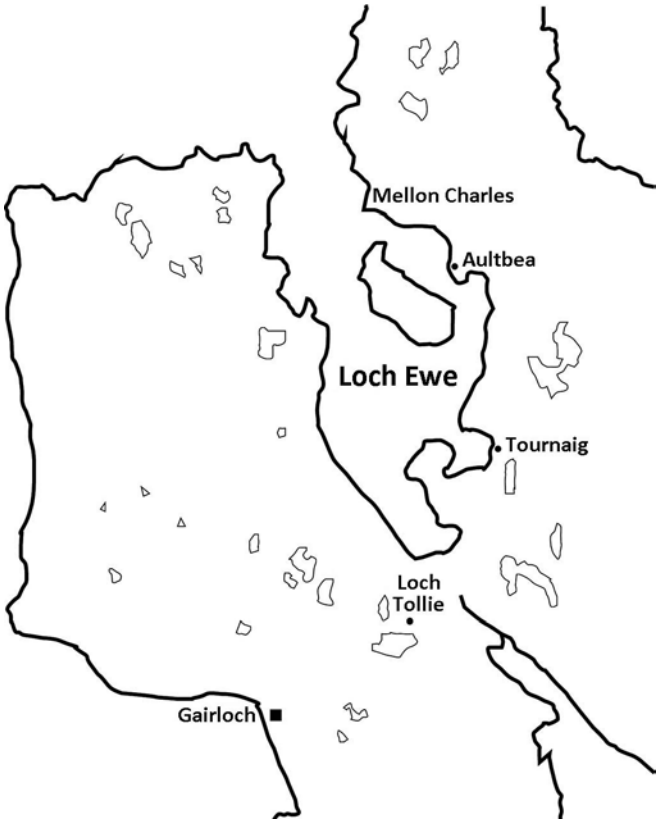
The restoration efforts at Barnton Quarry, Edinburgh, are also well known to *Subterranea* readers. This underground ROTOR R4-type bunker, 200 miles southeast of Gairloch, functioned as Scotland's sector operations centre (SOC). As the central nucleus for air defences, Barnton Quarry was to collate radar and ground-based ROC flight data that would be used to calculate direction and altitude of incoming Soviet bombers. Once assessed this invaluable information would be transmitted to sites like Gairloch AAOR via a network of buried General Post Office (GPO) telecommunications lines.

Not only have the efforts at Barnton Quarry been rewarded in 2021 with Category A listed building protection – the highest available from Heritage Environment Scotland (HES) – but the 1950s bunker has more recently been approved for planning permission. This is another key milestone ahead of its public opening as a dedicated museum for ROTOR radar and a combined meeting/conference facility (*see Subterranea* 59).

Last line of defence

Amid all this recent excitement and attention in Scotland over Gairloch's adaptive reuse and Barnton Quarry's faithful restoration, few will be familiar with the lesser-acknowledged structures of the broader ROTOR programme. Examples are the anti-aircraft (AA) batteries conceived as a last line of defence during the early Cold War threats, organised across Britain's 32 gun defended areas (GDA) of which four were located in Scotland at Gairloch, Craigiehall, East Kilbride, and Inverkip.

Although their overall layout varies, AA batteries were typically positioned in clusters of four with additional lightweight timber structures built nearby, supplying communications and support facilities. Although these sites didn't witness physical battle during their operational status, had Soviet aircraft been given their target orders, and had they escaped interception from scrambled RAF fighter jets, these AA batteries were given the crucial function of downing Soviet bombers before they released their atomic payloads. (Although the hydrogen bomb was successfully tested by the Soviets in 1953, according to political historian R N Rosecrance, Britain's military planners projected the atomic bomb as the more likely threat.)



Map showing potential Cold War AA batteries as part of Loch Ewe GDA

While most of the ROTOR programme was operated by the RAF, the AA Command (including AAOR bunkers and AA batteries) was the responsibility of the Army. As part of the post-World War II defence assessments the British government opted to preserve a fraction of over 1,000 heavy AA gun sites leftover from the war. In line with increased geopolitical threats posed to the UK, figures for approved AA installations fluctuated from the mid-1940s to early 1950s. Those that were sanctioned represented a patchwork of retained and reused Second World War guns combined with other new purpose-built Cold War schemes.

This defence plan, however, was short lived and the Army's AA Command stood down in 1955 due to advances in high-altitude Soviet aircraft and higher speeds of guided missile delivery systems. Although a significant portion of the large-scale bunkers within the ROTOR programme saw immediate reuse for a range of functions – typically after undergoing internal alterations – recycling options for the smaller AA batteries have been more limited.

Loch Ewe GDA

First utilised as an anchorage in World War I, Loch Ewe later functioned as a key naval base during World War II; providing Allied navies with a deep-water link to the Atlantic Ocean and a vital supply route for the Arctic convoys dispatched to Archangel and Murmansk in the Soviet Union. Post-World War II, Loch Ewe retained its strategic importance (and heavy defences) during the Cold War by hosting a NATO refuelling depot and a vital docking station for ships and nuclear submarines.

Due to this long military past I made an extended foray north of Gairloch Museum during my last visit and spent an extra hour exploring a sample of the remaining AA batteries positioned around the Loch Ewe GDA. Firstly I drove along the full trail to assess what physically remained before returning to investigate the sites closer on foot, photographing what I could as a means of documentation.

During this extended journey I managed to find the remains of Aultbea, Tournaig Farm, and Loch Tollie before getting lost on private farmland in search of Mellon Charles. Apart from Aultbea, which is now preserved as an informal tourist-like site of historical interest, others have 'gone on to pastures new' as they assume more humble agricultural reuses as farm storage and cattle shelter. Some have simply been abandoned in the landscape and others have been infilled with soil and capped with grass. The resultant series of mounds look more like medieval period fortifications than 20th-century nuclear warfare defences.

Old and 'new'

Certain Cold War AA batteries were purpose-built using reinforced concrete and embedded into the natural terrain to conceal their position from Soviet surveillance. Examples of these can be located within Glasgow's rural peripheries (as recorded by Historic Environment Scotland and available through the Canmore online database) at Stockiemuir, Pattiston, and Limekilnburn. Others however, such as those found at Loch Ewe GDA, were recycled remnants of earlier World War II installations.

This reuse policy was in the name of economic frugality in which Britain's air defences, along with most other civil defence plans, were both scrutinised and begrudgingly sanctioned by the Treasury. Thus, the rationale of refitting already built World War II concrete structures and installing updated weaponry allowed significant savings in material and labour, both of which were scarce in the 1950s. This process of continued use during the Cold War doesn't detract from the architectural history; actually it emphasises the robustness of the World War II concrete construction.

Aultbea AA Battery

The sole remaining AA battery found at the western side of Aultbea, a small fishing village approx 12 miles north of Gairloch, has become an informal, impromptu heritage monument. Beyond the Highland Council information boards detailing Loch Ewe's military history there is only a lonely casemate, as the rest of this cluster group has been removed.

Architecturally this structure has been cast in situ of reinforced concrete, which is slowly being claimed by the natural vegetation. Whilst the ammunition and actual gun have long gone (likely salvaged for its valuable steel) there are fixings left visible in the centre of the compound. These indicate where the weapon was secured to the concrete base using holdfast bolts.

Aultbea AA battery (note the holdfast indicating position of removed AA gun)

Detail of remaining holdfast fixings

Concrete radiates outwards from the central holdfast position

Detail of in-situ concrete ammunition locker

In plan, a series of rectilinear structures radiate from this central point, offering shelter for the AA crews and storage lockers for the magazine rounds. This standardised layout allowed for an uninterrupted 360-degrees rotation of the AA gun so it could engage incoming overhead targets.

The concrete structure stands about six feet in height and is still mostly in good condition. Aside from visual weathering of the material and nonsensical graffiti, there are a few sections where the concrete shows cracks and spalling of the concrete coming loose from the steel reinforcement bars. Rusted rebar is now poking clear of the slab.

Decay of in-situ concrete structure showing exposed rebar

Across other sections, weathering and decay have stripped the outer layer of concrete and revealed the inner aggregate used for the concrete mixture. The range of small and large pebbles in the aggregate suggests the constructors, whether private building firms or the Royal Engineers, made use of the surrounding beaches within the local area. The concrete walls have clearly been cast in situ using corrugated metal sheeting as formwork, given the wave-like patterning of the concrete surface texture, running in a vertical top-down fashion.

Where these corrugations stop they are capped with a simple concrete lid about ten inches in depth. From the top of this single-level structure the view of Loch Ewe is picturesque. It is difficult to imagine this idyllic Highland scene as the stage of a last-ditch defence effort against nuclear annihilation during Cold War tensions.

Concrete spalling reveals the pebbles used as aggregate. Note the exposed rebar

View of Loch Ewe from Aultbea AA battery (looking west)

Tournaig Farm AA battery

Five miles to the south of Aultbea is the Tournaig Farm AA site, which has four remaining batteries that I almost missed when driving on the main road that passes east of the farm. Parking on a slither of a layby and peering over the farm's fence line I quickly forgave myself as all four of these batteries are set much lower within the terrain and vegetation obscures what little pokes out of the top.

The in-situ concrete structures appear to be faring much worse than at Aultbea, indicating much more evidence of spalling and sections completely sheared off. However, most interesting is the different construction approach found at Tournaig Farm.

Tournaig Farm AA batteries. Note horizontal lines from in-situ concrete formwork

Instead of the corrugated expression of Aultbea, it is clear from horizontal shuttering lines that the material has been set using flat timber board lengths – a much more common approach with setting concrete formwork. In lieu of a public information board were a handful of cattle grazing around the AA batteries, and internal gun holdfasts were now being used for storing agricultural equipment.

Tournaig Farm AA batteries. Note horizontal lines of in-situ concrete formwork

Tournaig Farm AA batteries. Note decayed sections of in-situ concrete

On looking across the field and beyond to the loch, the composition of the lush green terrain strikes a resonance with the above-mentioned nuclear apocalypse paradox. If there were to be road-mounted information boards detailing the site's historical function to passing tourers on the NC500 route, would it perhaps tinge the innocence of the scenery?

View of Loch Ewe from Tournaig Farm AA batteries (looking west)

Loch Tollie AA battery

Another five miles south of Tournaig Farm I arrived at my last location just off the main road at Loch Tollaidh. Unlike the other AA sites, the four batteries here are all but entirely covered with topsoil, long grass, and native Scottish wildflowers. Unless you came looking for the said batteries (as I did) a chance encounter is nearly impossible.

Loch Tollie AA batteries. The mound now conceals the concrete structure

Next to a rusty shipping container a row of huge timber pylons, carrying overhead electricity lines to surrounding homes, now cut through the site. The actual concrete batteries are still underneath all this coverage but at surface level there are only four grassy knolls available for interpretation. Whilst exploring these mounds through boggy ground conditions, I only just managed to find a couple of isolated pockets where the concrete had breached the surface. At one distinct point I could see a squared corner poking from the soil blanket.

Exposed section showing in-situ concrete structure of AA battery

The corrugated concrete profile and pebbled aggregate visible here is similar to that found at the Aultbea battery. Before leaving I turned and viewed the site again; and, as with the others, the most idyllic setting conveyed the placidness most associated with the Scottish Highlands and afforded no hints towards its previous Cold War history.

View of Loch Tollaidh from AA battery site (looking south)

Problematic sites

While the main bunkers that coordinated Scotland's overall air defence (that is Barnton Quarry SOC and Gairloch AAOR) have seen more progressive reuses and attention, the AA batteries tell a different but equally important story. From the three narratives presented above this side of the ROTOR programme appears to have generally seen a more widespread abandonment.

These sites may offer intrigue as architectural/archaeological remains left within the natural landscape; however, they may also linger as visceral reminders to locals of an overbearing military past and the very real nuclear threats of the Cold War.

Perhaps visitors to both Gairloch Museum and the future Barnton Quarry facility are less inclined to feel such a tangible connection with the conflict side of things, given that they are a further degree removed from the potential AA battlefields. For had tensions boiled to a point of action in the early days of the Cold War, these AA batteries assigned to defend Loch Ewe, along with others at Craigiehall, East Kilbride and Inverkip, would have most likely served as Britain's front line.

All photographs and drawings are by the author unless otherwise stated.

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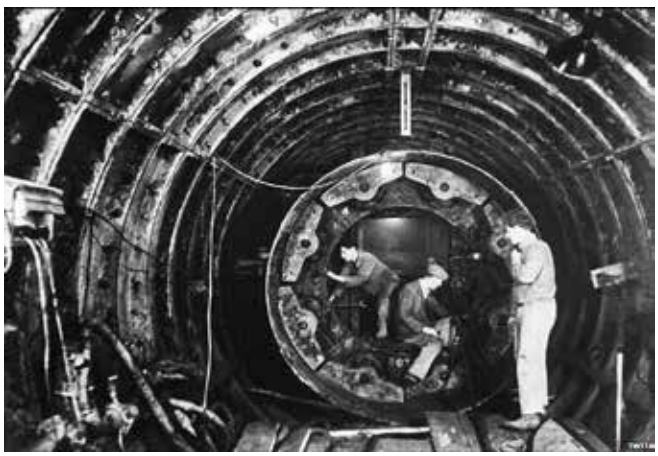
The Tyne Pedestrian and Cycle Tunnels

Phil Thirkell

The entrances at the bottom of the escalator to the two tunnels

Before 1930 there had been several proposals for road, bridge and tunnel schemes under the River Tyne east of Newcastle, mainly between North and South Shields, but it wasn't until 1937 that a committee of local authorities agreed that a tunnel was the only practicable option. After much discussion and argument between the various local authorities, and despite the Second World War, a decision was made in 1943 in favour of a tunnel crossing between Jarrow and Howdon.



Shield chamber under construction.
Photo from Tyne & Wear Archives and Museums

Road tunnel is deferred

An Act of Parliament in 1946 authorised the building of the Tyne Road, Passenger and Cyclist Tunnels between Jarrow on the south bank of the river and Howdon on the north, about six miles downstream (east) from Newcastle. Unfortunately, due to restrictions on capital expenditure, work on the road tunnel was deferred until 1961–67. However, the Act provided for the construction

Tyne pedestrian tunnel under construction.
Photo from Tyne & Wear Archives and Museums

Three old abandoned mine shafts were discovered on the north approach and were sealed. Before tunnelling work began, trial borings were carried out on the tunnel approaches on both banks of the river so the engineers were not completely unaware of what they might encounter but, because of the narrowness of the river at this point, it was deemed impossible to obtain meaningful information regarding the ground under the river.

The work of driving the tunnels began in June 1947 on both sides of the river with the 200ft-long, steeply inclined escalator tunnels. Initially it had been planned that the tunnels would be accessed by lifts, thus reducing their length but, by this time, it had been decided to use escalators instead, whilst retaining the lifts for those unable to use the escalators. As a result of trial borings, it was decided to drive of a 12ft diameter tunnel for cyclists and a smaller one of 10ft 6ins diameter for pedestrians; work was to start the following year, 1947.

The cost of the tunnels was estimated at £900,000, 75 percent of which would be met by a grant from the Ministry of Transport. The balance was to be paid jointly by Durham and Northumberland County Councils, and the project was to be overseen by a Tyne Tunnel Joint Committee consisting of representatives of the two County Councils.

The Joint Committee appointed Messrs Mott, Hay & Anderson as consulting engineers to prepare the detailed plans and superintend the construction of the tunnels. The company had much relevant experience having been involved with similar projects such as London's Underground Railway and the Mersey, Blackwall and Dartford road tunnels. The main contractor was Charles Brand & Son Ltd with Waygood-Otis providing the escalators and lifts.

Underground problems

The geological conditions were to cause great problems: coal measures consisting of shale, sandstone and small seams of coal, usually fissured and faulted; and glacial drift deposited when the last Ice Age retreated and consisting of boulder clay interspersed with watery beds of silt and gravel.

In the clay were embedded boulders, some very large and of varying nature from soft sandstone to extremely hard dolerite whinstone, which necessitated blasting. To add to these difficulties, below the line of the tunnels were the abandoned workings of the old Jarrow and Howdon collieries.

Near disaster

Howdon Rotunda and entrance. Also shows a piece of public art called Echo *by Fiona Gray.*

By January 1949, the miners driving the 12ft cycle tunnel from the Howdon side realised that the anticipated rock cover was non-existent and that there was only gravel and silt between them and the river above. Unknowingly they had broken into an ancient river channel filled with alluvial deposits.

For a while, the compressed air was sufficient to hold back the water, but eventually escaping air caused a crater 12ft deep and 40ft wide in the bed of the river. Work at the face was suspended while the crater was plugged with material dropped from hopper barges but tunnelling conditions soon became difficult again so it was decided to proceed by enlarging to full size from a 7ft-diameter

The Howdon wooden escalator

shield-driven pilot tunnel. The completed tunnels were lined with cast-iron segments.

On 7 March 1950 a ceremony was performed by the Lord Lieutenant of Durham to celebrate the completion of the tunnelling. Because of the engineering problems, the cost was £200,000 over the original budgeted cost. The 900ft-long completed tunnels were officially opened on 24 July 1951 by the Rt Hon Alfred Barnes MP, the Minister of Transport. The Waygood-Otis escalators that were installed in the inclined approaches had, at that time, the longest continuous lift in the world with a vertical rise of 85ft.

The two escalators at the Howdon (north) end in January 2012 before the left-hand one was removed for the refurbishment

Grade II listing

In May 2000, the historic and architectural importance of the tunnels was recognised by the designation of Grade II listed building status. It was also recognised that the tunnels constituted part of the area's contribution to the 1951 Festival of Britain.

At the peak of their usage, the tunnels were being used by 20,000 people per day, mainly workers employed on both sides of the river in the shipbuilding, lead and chemical works. Because of the downturn of industries on the River Tyne, and spiralling costs of repairing frequent breakdowns of the lifts and escalators, it was decided to close the tunnels for refurbishment. By this time, in 2013, usage had reduced to 20,000 people per month.

Six-year closure

The tunnels were closed in May 2013 to allow a local contractor, GB Building Solutions, to carry out a £4.9 million refurbishment that included removing two of the original four escalators and replacing them with two new funicular-style, glass-sided lifts. After numerous delays, including the contractor going into administration, the tunnels and the vertical lifts reopened in August 2019. By December that year, the tunnels were being used by 20,000 Tynesiders per month of whom 25 percent were cyclists.

At the time of writing (March 2022), the tunnels are now open 24/7, free of charge. The new inclined lifts are in place but testing and certification needs to be completed before they can be used. The public will be able to view the two remaining original escalators which will be illuminated with feature lighting.

The county boundary between the old counties of Durham and Northumberland looking south

The county boundary looking north during construction of the tunnel. Photo from Tyne & Wear Archives and Museums

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Photographs by the author unless stated.

The Highgate Cemetery Catacombs

Stephen Sowerby

Highgate Cemetery lies in two parts, east and west of Swain's Lane, Highgate, London N6 and dates from 1839. It is where many famous people are buried, including Michael Faraday and Karl Marx.

Interior of the eastern range of the Terrace Catacombs. www.frommers.com

Christian Catacombs of Antiquity

The Victorian vogue for incorporating catacombs within cemeteries can be traced to the Christian catacombs constructed around Rome from the second century AD. These underground burial structures consisting of multi-tiered rows of coffin niches would be imitated by the Victorians as part of their inimitable mourning culture and taste for grandiose commemorative display.

The Latin term 'catacomb' rather prosaically originates from the locality of *ad Catacumbas* on the *Via Appia Antica,* about two miles south of Rome's Aurelian walls. Here a catacomb was constructed under the shrine of the relics of St Sebastian, a revered Christian martyr, in the third century AD, which became the most popular place of underground burial in early Christian Rome. It is from the underground burial complex at *ad Catacumbas* that the term 'catacomb' derives.

Why the Christians of late antiquity chose to bury their dead in subterranean burial structures is surprisingly complex and beyond the scope of this study. Suffice it to say that the simple rock-cut sepulchre (or tomb chamber) in which Jesus was entombed was a significant motivation for this early Christian burial

Stone coffin niches in the catacombs of Santa Sebastian, Rome. insidethevaticanpilgrimages.com

tradition. Indeed, the deep significance of Christ's place of burial on the Victorian mindset can be seen in the majestic array of sepulchre-inspired chest tombs and mausoleums within their cemeteries, although these funerary monuments must not be confused with catacomb burial structures.

Stone coffin niches in the catacombs of Santa Callixtus, Rome. getyourguide.co.uk

The Church Crypt

Whilst the early Christian catacombs were undoubtedly a major vector in the Victorian vogue for building catacombs, the residual legacy of the Church crypt was probably of equal significance. The crypt (when existing) is the semi-subterranean space beneath a church typically found under the entire footprint of the building. During the late middle ages it would become common practice for deceased members of the parish clergy and local gentry to be interred in tombs or purpose-built vaults (chambers) within the crypt driven by a desire to be buried as close to the high altar as possible and thus closest to God.

During the seventeenth century the growing middle classes, seeking the social distinction of burial alongside the local gentry, would begin buying or wheedling their way into the parish crypt, a practice essentially confining the poorer echelons of the parish to the churchyard. Those not afforded the privilege of burial within the crypt could pay more for a grave against the outer wall of the chancel (the room containing the high altar) or for burial under the floor of the porch which was at least technically inside the church.

Those privileged or wealthy enough to be interred within the crypt would seek to be placed as close to the high altar as possible with coffin spaces becoming less desirable the further west of the altar their location. Nevertheless, any position within the crypt was seen as preferable to burial within the churchyard for reasons of social exclusivity, Godliness and security. Interment was typically in lead-lined richly decorated wooden coffins housed in either family vaults (stacked or on shelves) or placed individually on shelving – the whole tableaux being reminiscent of burial within an early Christian catacomb. Burial within the church crypt would reach its modish zenith, with grandiose and ornate coffin decoration, during the eighteenth century after which most crypts were filled to capacity (if not before), compelling the middle classes to slum it with the parish poor in the churchyard once more – just with grander monuments.

The Magnificent Seven

The enduring middle-class memory of interment within the church crypt, fuelled by a rural nostalgia for the village church, was astutely reflected by the inclusion of distinctive catacomb structures within London's new commercial cemeteries. These seven privately owned cemeteries, now collectively known as The Magnificent Seven, were laid out within verdant garden landscapes around London's green fringe (now firmly inside suburban London) between 1833 and 1841 offering both consecrated (Anglican) and non-consecrated (non-conformist) burial spaces.

Four of the Magnificent Seven (Kensal Green, West Norwood, Nunhead and Tower Hamlets) emulated the church crypt through the construction of catacomb structures directly beneath their mortuary chapels – West Norwood's Anglican catacombs retain a particularly impressive assemblage of mock-medieval vaults and coffins.

A deliberately picturesque view of West Norwood Cemetery emphasising its landscape garden qualities – note the Anglican and Non-conformist chapels atop the hill. 'The Illustrated London News', 15th September 1849. Author's collection

Highgate Cemetery (of which more later) rather ingeniously constructed its largest range of catacombs directly under the high altar of a neighbouring parish church, thus quite literally creating a church crypt. The classically styled Brompton Cemetery incorporated catacombs under the two circular arms of colonnades leading to its Anglican Chapel. Only Abney Park Cemetery failed to build a grandiose catacomb structure reflective of its non-conformist status and mindset which disapproved of elitist catacombs. The small semi-subterranean catacomb structure at Abney Park was deliberately separated from its chapel thus breaking the middle-class (and high-church) associations of burial within the church crypt.

Much has been written on London's Magnificent Seven and the garden cemetery movement (including an excellent article in Issue 21 of *Subterranea* on West Norwood's catacombs) and space precludes further exposition here. Those wishing to know more should seek out James Stevens Curl's various publications on the Victorian cemetery, particularly his superlative *The Victorian Celebration of Death*.

Highgate Cemetery

Constructed almost contemporaneously with West Norwood in 1836 but not opened until May 1839 due to local opposition, Highgate Cemetery would become London's most picturesque cemetery and the true heir to Paris's Père Lachaise. Described as the most unashamedly romantic cemetery in Britain, The Cemetery of St James at Highgate was the child of the London Cemetery Company whose entrepreneurial founder and architect, Stephen Geary (1797–1854), understood the value of a picturesque view. Not only did the location clinging to London's northern heights command sublime views across the Metropolis, it lay within the former garden of the demolished Ashurst House contextually befitting a garden cemetery.

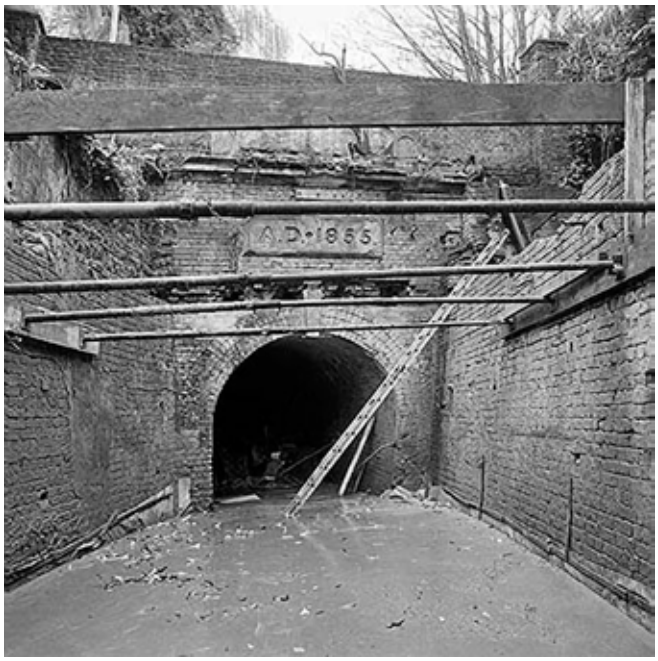
A pre-1854 view of Highgate Cemetery (before the opening of the eastern cemetery) emphasising the cemetery's pastoral and Arcadian qualities with the chapel building and Superintendent's house in the foreground. Unknown publication. Author's collection

The old house was replaced by Highgate's new Anglican Church of St Michael in 1832 whose gothic profile towering above the cemetery's northern extremity (the church is the highest in London) would become a dramatic backdrop to the panoramic viewing platform constructed on the roof of the catacombs beneath. Whilst officially unrelated, the tableaux of church and cemetery would become a popular image with contemporary illustrators giving the comforting impression of a giant churchyard.

At first opening, the visiting public entered the cemetery via a gate next to St Michael's Church directly onto the viewing platform, soon becoming a favoured place for middle-class promenading, whereas funeral parties entered via the chapel gates on the lower slope, thus keeping the two distinct types of visitor respectfully apart. However, the roof terrace entrance was closed within months due to complaints over noise and loss of privacy by neighbouring residents.

Like the finest landscape gardens, the approximately 17-acre western cemetery was designed to impress, sooth, and stimulate the senses through the Arcadian lushness of its grounds to the romantic qualities of its buildings and architectural features. The cemetery entrance consisted of two chapels, one for Anglicans and one for non-conformists, within a single Tudor Gothic-style structure ornamented with dramatically looming pinnacles and cupola crowned bell tower, divided by a central archway. The cemetery Superintendent's office was ingenuously situated above the gated archway providing commanding views into the western and latterly eastern cemeteries with internal windows to view chapel services – a superb Panoptic design.

The opening of the 19-acre eastern cemetery in 1856 was legally facilitated by the construction of a tunnel under Swain's Lane (which divides the cemeteries) providing the company with the opportunity to install a modish hydraulic coffin lift (catafalque) in the Anglican chapel. Once lowered into the crypt the coffin was carried through the tunnel into the eastern cemetery for burial.



Restoration work is underway on the tunnel approach in the East Cemetery in the 1980s. Photo © Historic England

Just across Swain's Lane stands the cemetery Superintendent's house. This small, whitewashed mock-medieval building adorned with battlements, turrets and pinnacles is strongly reminiscent of Horace Walpole's 'little Gothick castle' of Strawberry Hill, Twickenham. Whilst it may seem slightly incongruous for the starchy Superintendent of Highgate Cemetery to reside in a fantasy gothic castle it was entirely in character with the quirky exoticism of the cemetery's landscape architecture.

The chapel gateway enters a spacious courtyard framed by a concave colonnade enticing visitors to the central steps dramatically ascending into the cemetery. The colonnade, added around 1842, deliberately screens off the cemetery beyond emphasising the dramatic transition between the land of the living and the land of the dead. Carriage drives sweep either side of the colonnade into the cemetery's verdant hinterland of serpentine roads, paths, and rising terraces where, as the

Penny Magazine eulogised to its readers in 1839, *'... parterres of sweet-scented flowers, picturesque trees, and clumps of evergreens are scattered in the most appropriate spots'.*

Indeed, such was the sensory impact of visiting the cemetery in the nineteenth century that some contemporary reviewers found themselves compelled to impart their experiences in sentimental verse (not worthy of repetition). The cemetery would become a hugely popular visitor attraction (the first guidebook was published in 1845) to the point where an admittance ticket was required for Sunday entry, a popularity causing the Secretary of the Abney Park Cemetery Company (not forgetting a commercial rival) to snootily observe that he had witnessed *'picnic parties on consecrated ground!'.*

'Egyptomania' and the Cemetery

Whilst Napoleon's invasion of Egypt in 1798 was a military failure it was accompanied by 167 civilian scientists and scholars whose pioneering endeavours opened up Western understanding of what had become a lost civilisation – including launching the new discipline of Egyptology. The campaign's subsequent archaeological excavations and scholarship created a fervour of interest in ancient Egypt in the West (becoming known as *Egyptomania*) finding expression in a plethora of cultural, decorative and aesthetic aspects – not least in architecture.

Period colour engraving of the façade of William Bullock's Egyptian Hall, now 170-173 Piccadilly, London. Unknown publication. Author's collection

The first public building in England (probably in Britain) built with an exterior in the Egyptian revived style was The Egyptian Hall, now 170-173 Piccadilly, London, in 1811–12. The building was designed by Peter Frederick Robinson (1776–1858) to display William Bullock's collection of curiosities. Whilst the building's façade included copious Egyptian design elements it did not attempt to accurately recreate an ancient Egyptian temple, somewhat typifying the approach taken to the Egyptian revived style in England.

The building's Egyptianising design elements, built on a grand scale, were deliberately designed to make the building stand out within the streetscape – what has since been described as 'commercial picturesque' architecture. The Egyptian elements displayed on the building's façade included the cavetto cornice, torus mouldings framing the building, pylon formed windows, and grandiose portico flanked with bud-capitaled columns and winged globe above. Design elements that would be powerfully imitated in the funerary architecture at Highgate.

Nevertheless, the Egyptian Hall was more than a monumental Egyptianising façade, it contained a rather garish Egyptian styled interior hall. The hall would most appropriately host a hugely popular exhibition of ancient Egyptian artifacts during 1821–22, artifacts mostly taken from the ongoing excavations in the Valley of the Kings, including the recreation of a pharaonic burial chamber. This year-long Egyptian spectacular would fuel the fervour for ancient Egypt and Orientalist art and decor among England's high society and intelligentsia.

The Egyptian style in architecture was essentially an alternative form of Gothic characterised by its monumental scale, vibrant colours, and romantic associations. Its monumental scale and decorative qualities made it particularly well suited to imposing or large-scale buildings (with the added advantage of being cheaper to build than the gothic style).

The obvious associations between Egyptian architecture and death were palpable to a nineteenth-century public increasingly engrossed in a sentimental cult of mourning. It is therefore no surprise that the era's fascination for ancient Egypt was perhaps nowhere better expressed than in the Victorian cemetery, not just in the prevalence of the obelisk, but in the exoticism and grandeur of its monuments and mausolea. Indeed, the Egyptian style's potential for commercial exploitation as funerary architecture would be repeatedly exploited within Victorian cemetery design – and Highgate was the first British cemetery to do so.

Egyptian Avenue

An 1838 engraving of the Egyptian Avenue in its original tunnel construction with winged globe strikingly clear above the archway tunnel – note the two people looking over the parapet of the tunnel roof . 'The Mirror', vol 32, November 1838. Author's collection

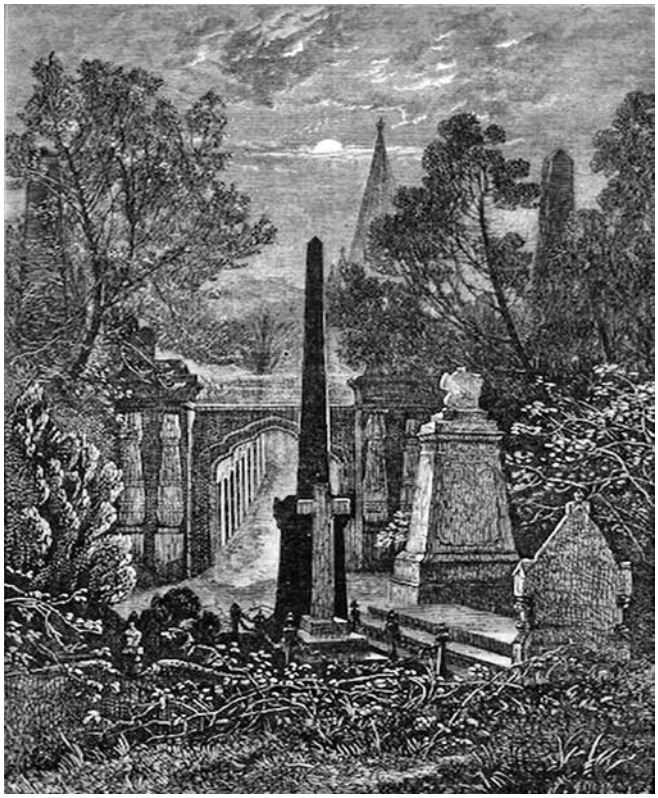
Highgate's entrepreneurial architect, always ready to exploit a vogue for profit, incorporated into its design an imposing Egyptian façade fronting a barrel-roofed tunnel of sixteen catacombs (or vaults) leading to a circle of catacombs built around a highly picturesque Cedar of Lebanon. Whilst the tunnel's roof was removed in the late 1870s to make the vaults more saleable, the sloping passage of catacombs naturally arouses connections with the Valley of the Kings and a theatrical sense of exotic foreboding and sepulchral decay, greatly enhanced by today's overhanging foliage. However, the sense of romantic decay is unlikely to have been aroused in the Victorian visitor as the decay did not set in until the 1950s; their response would more likely have been one of awe in beholding the sublime monumentality and exotic romance of the Egyptian Avenue ahead.

The Egyptian Avenue facade today with dramatic overhanging foliage and no longer a tunnel. www.itsalltriptome.com

Highgate's Egyptian Avenue would become the cemetery's principal architectural feature, as it remains, much reproduced in Victorian illustrations of the cemetery. The design elements of the Avenue's façade were undoubtedly greatly influenced by the façade of the aforementioned Egyptian Hall – particularly its portico – which is a building Geary would have known well. The Avenue's façade centres on a corbelled archway portico framed by decorative torus mouldings, paired Egyptianising columns, with lotus bud capitals, and flanked by two monumental guardian obelisks.

Directly above the archway was a winged globe, which no self-respecting Egyptian Revival design could do without, the whole façade topped by a cavetto cornice (the winged globe was sadly removed with the tunnel roof). The façade was constructed of whitewashed stucco-faced brick which would have shone dramatically in the afternoon sun – the whole remains an outstanding example of 'commercial picturesque' architecture.

Whilst the loss of the tunnel roof reduces the sense of the Egyptian Avenue being underground, both the Avenue and Lebanon Circle were excavated into the side of the hill and so the vaults are technically underground even if they are not entered via steps.



Highly romanticised view of the Egyptian Avenue by moonlight in 1877 showing the winged globe and decorative central cornice now removed. The picture suggests the tunnel roof is now gone although this is less clear possibly indicating the roof is in transition at this point. 'Old and New London: The Western and Northern Suburbs', by Edward Walford, volume 5, 1877. Author's collection

The sixteen catacombs within the Avenue are entered through imposing cast-iron paired doors, each decorated with an inverted touch symbolising 'life extinguished', framed by decorative torus mouldings with family name proudly proclaimed above the door. Each vault could house twelve adult-sized coffins laid sideways on shelving (four shelves against each of the three walls) although the scope of the shelving running in semi-circular fashion against the walls would have permitted smaller additional coffins to be deposited.

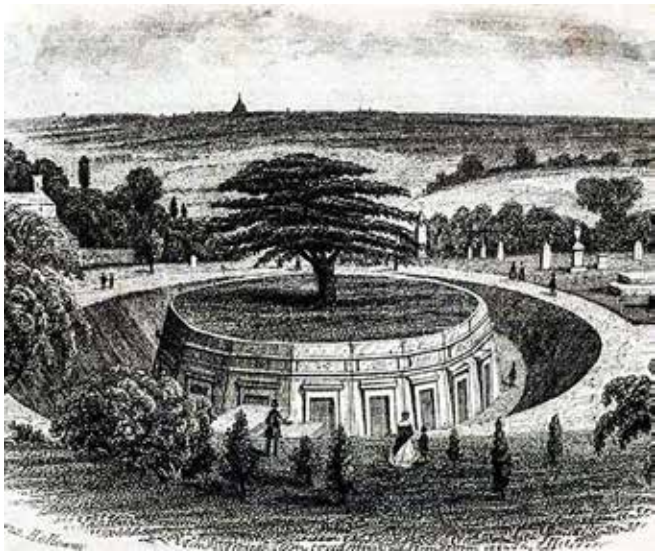
View inside the Egyptian Avenue looking towards the Lebanon Circle. www.frommers.com

The coffins would typically have been triple shelled with a middle coffin made from lead to hermetically

encase the body to prevent decomposition (in Christian tradition the body must be whole to receive resurrection) with a stout oak outer coffin. It should be noted that the Cemetery's 1883 Regulations stipulated that "no interment shall be made in a catacomb, vault, or brick grave unless the coffin be of lead, stone, or asphalt" – the latter two materials are unknown at Highgate although stone was a typical material for coffins in the catacombs of Christian antiquity.

Whilst the Egyptian façade's exotic grandeur would become a much-illustrated visitor attraction, the Egyptian Avenue nevertheless failed to generate the anticipated income as only six of the Avenue's sixteen vaults had sold by 1870 – it would take over sixty years for all the vaults to sell with the last finally selling in 1903 (George Chase, mining engineer). The Egyptian façade's pre-Christian architectural sentiments and the oft commented sepulchral gloom of the Avenue tunnel most likely accounting for the poor sales.

The Lebanon Circle



An early engraving of the Lebanon Circle with its majestic cedar tree before the construction of the outer circle as seen from the terrace viewing platform – note St Paul's cathedral on the horizon. Publication origin unknown – www.cemeteryclub.wordpress.com

The Avenue opens onto an elegant circle of twenty catacombs originally built beneath a mature and magisterial Cedar of Lebanon that had been the centrepiece of the former garden. Sadly, the ravages of time and disease would require the tree's removal in 2019 – a sapling cedar was planted in its place. The Lebanon vaults are similar in size and design to those within the Egyptian Avenue, the only difference being the lotus bud fluted entablature with cavetto cornice above the doorways.

Each vault takes at least twelve coffins on shelves, although there appears to be some variance in shelving space between the vaults. However, if we take the 1883 Cemetery Regulations as the final arbiter, these state that the Lebanon vaults have capacity for fifteen coffins (including vaults in the newly built Outer Circle) indicating shelving

Author saying his sad farewells to the cedar of Lebanon the day before its removal in August 2019. Author's photo

space for five coffins per wall, with the Egyptian Avenue having capacity for twelve coffins or four to a wall.

Directly in line with the Egyptian Avenue beyond the Lebanon Circle was a grand stairway leading out of the circle splitting into flanking exits. The circle's outer rim remained a grass bank – despite what early cemetery engravings may show – until the late 1870s.

Earliest known photograph (Stereocard) of Highgate Cemetery, dated to the winter of 1857-58, showing the original grass bank of the outer circle and grand stairway before the construction of Julius Beer's mausoleum. Author's collection

Highgate shrewdly catered for the socially aspirational, the new moneyed class, as no other London cemetery offered imposing readymade vaults for public purchase – including in such an exotically sculptured landscape. Whilst the first person to purchase a vault in either range of catacombs was an aristocrat, the Duke of St Albans, this was not typical of the middling (albeit wealthy) sort of person who usually purchased a vault in the Circle or Avenue catacombs complex. Census records show an array of men from the mercantile community, including a draper, coach builder, biscuit manufacturer, butcher, and wine merchant, buying vaults.

Vaults provided not only a final resting place for the whole family – united in death – but a stepping-stone towards social respectability. The Duke of St Albans purchased his vault (directly opposite the grand stairway) in August 1839 making it the cemetery's nineteenth grave purchase and the first within the Avenue or Circle. In paying £262 the Duke was making a fairly considerable financial outlay considering that an artisan of the period was taking home about £15 per year. Nevertheless, if the hefty upfront costs could be afforded then the buyer was demonstrating financial acumen in purchasing a readymade vault with room for at least twelve deposits (NB. the Duke of St Albans was interred elsewhere and the vault contains just three of his siblings).

The vault of the Duke of St Albans (note the ducal coronet above the doors) and the first vault sold within the Egyptian Avenue and Lebanon Circle. The vault is situated directly opposite the original grand stairway out of the circle. Author's photo

Sales within the Lebanon Circle were again disappointing – albeit less so than the Avenue – with the final vault selling in August 1874 for £157 (John Owen, timber merchant). Whilst sales may have been slower than anticipated, in terms of cost the Egyptian Avenue and the Lebanon Circle were the most socially exclusive part of Highgate Cemetery – no doubt why the Duke of St Albans was the first purchaser. The 1883 Regulations price a vault in the Avenue at £130 and a vault in the Circle at £200, whereas a brick-lined grave for twelve burials elsewhere in the cemetery would cost only £21.

Lebanon Circle inner and outer range of vaults – note the classical design of the outer circle vaults. www.viator.com

With all vaults in the Lebanon Circle sold, the London Cemetery Company considered the time was right to construct an outer circle of vaults during 1876–77. The Outer (or New) Circle of sixteen vaults were designed by Company architect, Thomas Porter, in a classical style to reflect current architectural tastes and – hopefully – encourage sales. The Outer Circle somewhat strangely did not form a complete circle of vaults around the Lebanon Circle (presumably due to the costs) with the western half of the circle being used for ordinary grave plots. A retaining wall replacing the grass bank completed the circular form of the outer circle.

Steps out of the Lebanon Circle adjacent to the last vault in the outer circle on left. To the front is the inner circle and to the right the western half of the outer circle used for ordinary grave plots. https://thirdeyetraveller.com

Somewhat incongruously two vaults in the gothic style were privately added to the outer circle during the late nineteenth-century including for the opera impresario Carl Rosa (1842–1889). The whole Circle thus becoming a charming reflection of changing nineteenth-century architectural tastes.

The construction of the Outer Circle heralded a significant phase of commercially driven building within the Circle and Avenue complex. The most significant change was the removal of the grand stairway to enable the city financier Julius Beer (1836–1880) to build a spectacular family mausoleum at its top – the steps being replaced by the mausoleum's deep crypt. Beer paid the London Cemetery Company £800 in July 1876 for this prime location before building, reputedly to a design by John Oldrid Scott, what is considered to be the largest private mausoleum in London.

View of the location of the grand stairway now the crypt of Julius Beer's mausoleum which towers above

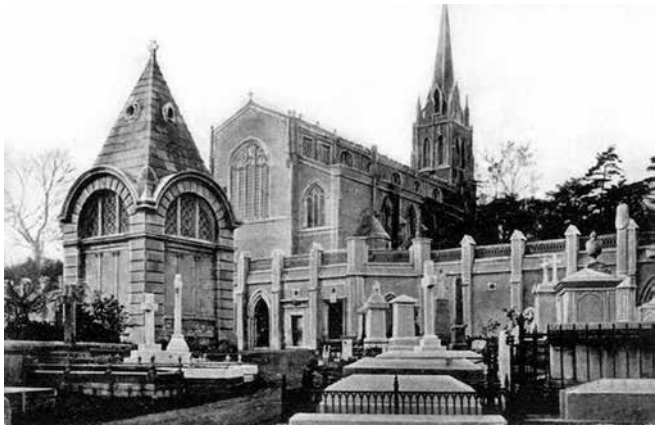
The fifty feet high structure built out of Portland stone and marble with a pyramidal roof was completed in 1878 (costing a staggering £5,000) and remains an imposing presence over the Lebanon Circle. However, the destruction of the grand stairway required new steps to be built and two simple stairways were constructed either side of the Outer Circle which was being built simultaneously.

Apart from the erection of Beer's mausoleum the most striking visual change was the removal of the Egyptian Avenue's roof (apparently to encourage sales) making it a passageway of vaults rather than a tunnel. As no specific written records relating to any of these building works survive (as far as we know) it can only be speculated that the tunnel roof was removed during the Outer Circle's construction. Furthermore, an engraving of the Egyptian Avenue from 1877 shows the façade missing its winged globe and central cornice indicating that the roof was removed around this time.

Stairway out of the Lebanon Circle with outer range of vaults to left. Author's photo

Whilst the last vault in the Outer Circle sold in 1916 (Radclyffe Hall, writer) meaning that all vaults had now been sold, few vaults – if any – were filled to capacity. Burial records indicate (the author did not inspect every record) that most vaults were not even half filled – several vaults have only one interment. This failure to maximise use of family vaults was bad news for the Company as they received an interment fee each time a deposit was made. It remains a moot point whether the Avenue and Circle complex must ultimately be judged a commercial failure.

The Terrace Catacombs



A pre-1905 photographic postcard showing the Beer Mausoleum (left), the terrace catacombs entrance with viewing platform above and St Michael's Church looming behind. Publication origin unknown – author's collection

Beyond the Lebanon Circle are the Terrace Catacombs built in the gothic style almost directly beneath the

high altar of St Michael's Church deliberately arousing medieval associations of interment within a church crypt. Being excavated into the side of the hill the catacombs are entered at ground level through an imposing gothic portico – there are two smaller doorways at the eastern and western ends.

Beer's Mausoleum entrance façade directly opposite Portico to Terrace Catacombs. Author's photo

The interior roof is splendidly vaulted enhancing the impression of entering a medieval crypt. The long roof terrace above the catacombs was designed as a viewing platform accessed by stepped inclines at either end fronted by a gothic style balustrade.

The roof terrace rapidly became a fashionable place for Victorian promenading – a place to be 'seen' as well as for 'seeing'. Indeed, it can be no coincidence that Seyssel asphalt was used to cover the roof considering its intended function as both a roof and a viewing platform (NB. there is no longer a view from the roof terrace due to the tree line). The Terrace Catacombs, as per Historic England's Grade II* listing, are considered to be 'probably the earliest surviving asphalted building in the country', although the asphalt has since been renewed.

Whilst the church crypt associations within the catacombs are clear and deliberate they nonetheless permeate a sense of the early Christian catacomb with their multi-tiered rows of coffin niches rising eleven feet to the ceiling. The eighty-yard linear range of catacombs is formed of fifty-five separate arched vaults containing

Gothic portico and main entrance to the Terrace Catacombs with roof terrace balustrade above. Author's photo

fifteen 'loculi' or niches for individual coffins – twelve for adults and three smaller niches for children on the top tier. Small glass apertures in the ceiling (originally iron grates) provide the only source of light invoking a profound sense of gloom on overcast days.

In the grandiose and distinctly ghoulish Victorian fashion, the expensive triple shelled coffins (elm, lead, oak) are ostentatiously displayed behind glass panels, iron railings, or interred behind polished marble slabs. Undertaker records indicate that it could take up to ten men to deposit these weighty coffins into a catacomb niche. Whilst the display of richly decorated coffins was clearly intended to be statement pieces (costing thousands in today's money) they also allowed for intimate grieving beside the coffin.

Vaults with coffin niches in the interior of the western range of the Terrace Catacombs. www.frommers.com

Burial records indicate that vaults were not sold individually; rather families purchased coffin niches as necessary (although a family tier of three niches is not uncommon), most likely due to their excessive cost. The 1883 Regulations price a coffin niche between £10.10 and £15.15, a very expensive outlay for only a

single coffin space – echoing the social exclusivity of burial within a church crypt. Both burial records and the 1883 Regulations indicate that costs were determined by location, with coffin niches in the middle of a vault being more expensive than lower and higher tiers. The first interment in the Terrace Catacombs was Mr Alexander Wood of Finchley Lodge, in September 1839, whose wife paid a hefty £28 for two coffin niches – albeit in a prime location facing the eastern entrance.

Commercially the Terrace Catacombs were relatively successful before rapidly falling out of fashion during the early part of the twentieth century whereafter sales became something of a rarity – around ninety coffin niches remain unsold. Whilst the Terrace Catacombs today are a forlorn reflection of their previous pomp, with egregious loss of décor, the vestiges of their former sombre glory can still be seen and sensed including some magnificent oak and brass fitted coffins.

The Terrace Catacombs included four paired vaults for private purchase either side of the main portico. Whilst these large vaults display imposing cast-iron doors their designs and that of their doorways differ. It appears from photographic evidence that the doorways were added only as the vaults were purchased which explains their bespoke appearance. In the 1883 Regulations these vaults are priced at £220 making them the most expensive readymade vaults in the cemetery – the first was sold to Sir James Tyler in 1858.

The paired doors entrance to the public vault with roof balustrade above. Photo Martin Brand

Juxtaposed to the grandiose pomposity of the coffins displayed in the main range of catacombs is the public vault discreetly tucked away under the western steps to the roof terrace. The public vault was a cheaper alternative to a niche in the Terrace Catacombs with the coffins tightly packed and plainly made not being intended for public display. It was not unusual for the public vault to be utilised for temporary coffin storage. Indeed, Charles Dickens interred his infant daughter, and ninth child, Dora Annie, in the public vault in 1851 before moving the coffin to his family grave elsewhere in the cemetery three years later.

The sublime interconnecting architecture of the Egyptian Avenue, the Lebanon Circle, and the Terrace Catacombs continue to beguile visitors today, as does Highgate's pervasive sense of romantic melancholy and reflective tranquillity, feelings that can only be experienced by a visit to the place.

NB. Access to the Terrace Catacombs is only available by guided tour of the western cemetery.

Stephen Sowerby MA

Friends of Highgate Cemetery Trust & Tour Guide

I must acknowledge and thank Mr Nick Powell, the Highgate Cemetery Visitor Experience Manager, for his assistance in accessing the cemetery's plans and burial registers. I must also thank Mr Stuart Orr, Trustee of the Friends of Highgate Cemetery Trust, who assiduously fact checked this article.

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Meet the Committee – Tim Wellburn, Chairman

I suspect my underground interest was kindled by childhood reading of *Pigeon Post,* which aficionados of Arthur Ransome will recall is based around the Lake District's abandoned copper mines. I hope to explore some similar mines during the NAMHO Conference this summer, so you might think I haven't moved on much in the meantime.

However, lots of other stuff claimed my time in the intervening years including, most importantly, family and, inevitably, work – although I always earned a living doing transport-orientated things that interested me, preferably in places I wanted to be.

This included a couple of spells working and living in the Far East – memorably first visited in the late 1970s aboard one of the last of Blue Funnel Line's classic cargo liners. I have managed to travel a great deal since, sometimes in comfort on business but also backpacking extensively in Southeast Asia.

Around 1990, having returned to the UK, I took myself off to do an MBA at Cranfield – my most intense year's work ever – and then joined the Department of Transport, working in a range of policy areas: aviation, shipping, logistics and, ultimately, railways, where my team was responsible for the strategic development of the rail network.

More readily-accessible interests than the subterranean world tended to occupy any remaining leisure hours: Welsh slate tramways and narrow-gauge railways, my MG Midget, historic aircraft and flying (the RAF having kindly taught me to fly at university).

With Kew Bridge Waterworks Pumping Station and museum on my doorstep, I inevitably became involved in that, both as a trustee and 'hands-on', getting very mucky helping to restore to steam the 70-inch cylinder Bull Engine – two levels of which are beneath the floor!

Copies of *Subterranea*, left enticingly in the Kew Waterworks mess room by Clive Penfold, drew me to Sub Brit around 2007 and all the underground delights which followed from that.

Retirement allowed me to pursue another long-neglected interest, in fortifications. I joined Fortress Study Group and, with Sub Brit and FSG friends, still spend much time exploring forts, counterscarp galleries and myriad other military tunnel systems in France, Gibraltar and many other places.

I can't quite remember when Martin invited me to join the Sub Brit committee, but I was happy to do so in order to give something back to the Society which had reignited my interest in the subterranean world, opened it up for me and made me so many new (and strangely like-minded!) friends.

The Sub Brit Forum
-or- How to keep up to date with events and news

If you are not using the Sub Brit Forum you will be missing out on news about events and on general information and discussion on underground matters. But did you know that you can still get any category of Forum posts **emailed** to you? To get this set up you will need to log on to the Forum at least once (see below). Once you are set up you can even reply by email to topics and automatically update the Forum. Here are some hints to help you.

First, Log on to the Forum (see below). Have a look round the Forum to see what's there.

You can browse **Categories** (eg 'Cold War', 'Transport') by clicking on 'Categories' in the middle of the top line (or in the box, top left, for a fuller display).

You can search for **Topics** (eg 'Tube Map') by using the 'Magnifying Glass' symbol near the top right-hand corner.

To get back to the Forum Home Page, click 'Subterranea Britannica' on the black banner.

To get **emails** (notifications) about material posted to the Forum:

click on the big bold letter (this will be the first letter of your username) or your photo, (if you've set one up) in the top right-hand corner

select the little man symbol, and then click 'Preferences'

then 'Categories', under 'Notifications' down the left-hand side

Select the categories you want to be notified about using the boxes on the screen.

You can also stop emails ('mute') about a topic or category here.

Another way to get email notifications, once you know the Categories you look at most:

1. Navigate to 'Categories' from the main Forum page.
2. Click the Category of interest.
3. In the top right-hand corner, click the button marked with a '🔔' next to 'New Topic' and select the type of notification you want. You will then get emails for every post here.
4. You can change your preferences at any time.

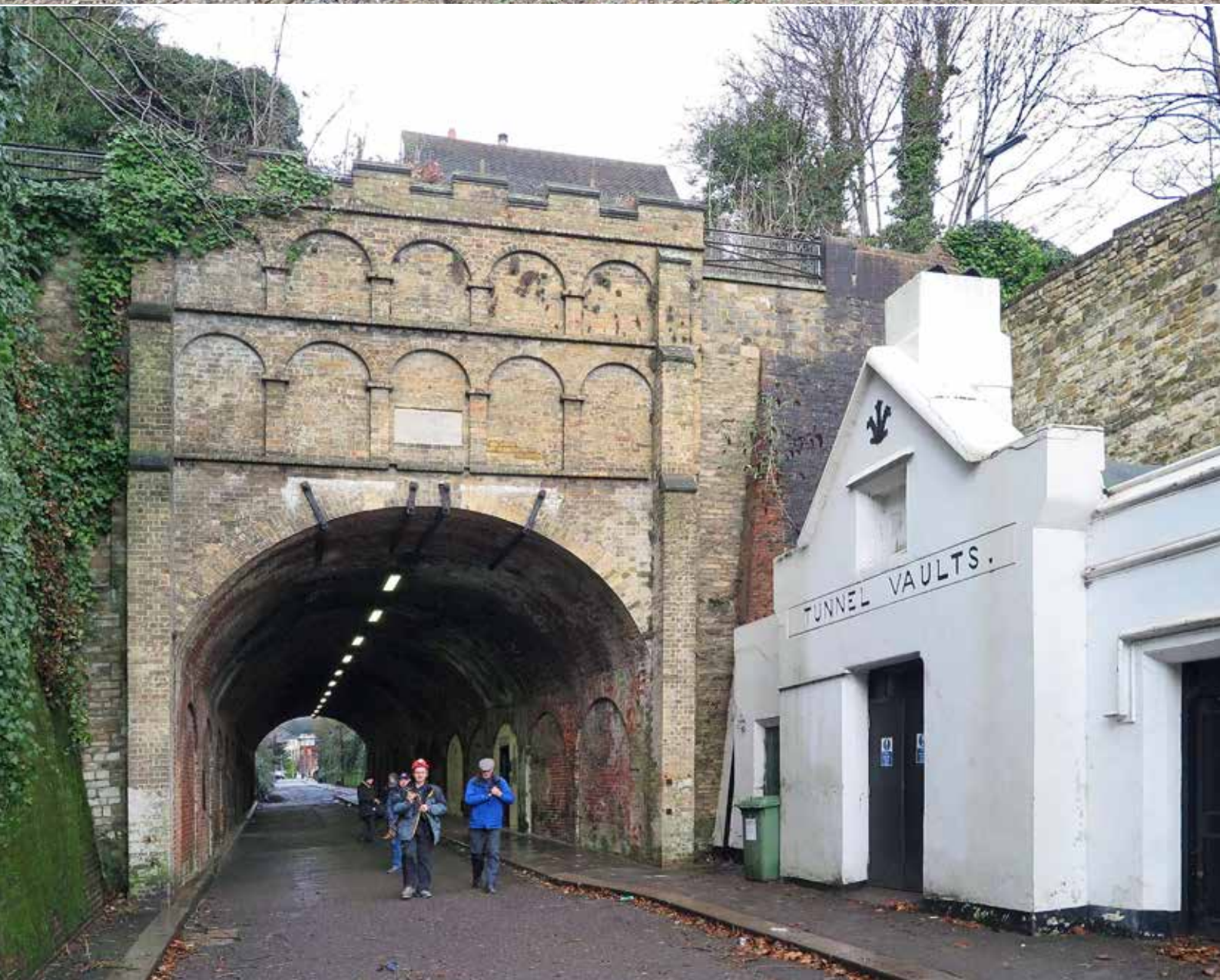
And if you don't want anything emailed to you – then we suggest you just browse the Forum!

How to log on to the Forum – reminder

* Go to https://community.subbrit.org.uk

* Log in using your membership username and password.

If you've forgotten them use 'Activate my account / Reset my password'.


TUNNEL VAULTS.